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THE HEALTH UNIT SYSTEM IN TROPICAL RURAL AREAS.

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The type of Sanitary Administration first formulated by me under the designation the Health Unit System was the outcome of a study of local conditions in Mauritius when the subject of the reorganization of the Medical & Health Department was being examined by a Commission appointed by the local Government in December 1927. It was my privilege to assume full control of the Department at the same time and to be faced with a rapidly falling budget due to the gradual development of the economic crisis which eventually made its presence felt all over the world. I thought that the best way to facilitate the work of the Commission would be to give it something concrete to discuss and the memorandum on Health Services in the Rural Districts was one of the documents submitted to them. It was in this memorandum that the Health Centre System was first defined and described.

To understand the considerations which led to the evolution of what might be termed the health centre idea, a brief description of the Colony is necessary.

Mauritius is a sub-tropical island in the South Indian Ocean, 720 square miles in area, lying about 1,500 miles to the east of the Natal coast. A glance at the accompanying map will familiarize the reader with its main features. Round the coast the land is low lying but it rises gradually towards the centre of the Island to about 600 feet. Thereafter the rise is steeper, so that the central districts of Plaines Wilhems and Moka, and part of Flacq, lie between 1,200 and 1,800 feet above sea level. The climate is not oppressive and there are distinct warm and cold seasons. The rainfall is abundant in the central part of the Colony. On the coastal belt the west and north are very much drier than the east and south.

The modern history of Mauritius begins in 1735 with the landing of Bertrand François Mahé de la Bourdonnais, who may be regarded as its founder. Since his time the Island has been in uninterrupted European occupation, first by the French, and, from 1810 onwards, by the British.

When the Island was first discovered by Europeans it was uninhabited. The Dutch occupied it from 1638 until 1710, in which year they withdrew, leaving behind them a certain number of escaped African slaves. The French occupation was effected by a settlement of a number of European colonists from the neighbouring Island of

Map showing Health Areas.

HOSPITALS AND DISPENSARIES are shown in the Map by Numbers as indicated below.

Port Louis.
- Civil Hospital ... 1
- Eastern Suburb ... 2
- Western Suburb (Bell Village) ... 3

Pamplemousses.
- Terre Rouge ... 4
- Pamplemousses ... 5
- Long Mountain ... 6

Rivière du Rempart.
- Poudre d'Or ... 7
- Ravin 8
- Grand Gaube ... 9
- Grand Bay... ... 10

Flacq.
- Flacq Hospital ... 11
- Trou d'Eau Douce 12
- Rivière Sèche ... 13
- Sébastopol 14
- St. Julien 15
- Brisée Verdière ... 16

Moka.
- Moka Hospital ... 17
- Pailles 18
- St. Pierre 19
- Quartier Militaire 20

Black River.
- Petite Rivière ... 21
- Bambous 22
- Tamarin 23
- Grande Rivière Noire ... 24
- Case Noyale ... 25

Plaines Wilhems.
- Curepipe 26
- Vacoas 27
- Victoria Hospital (Quatre Bornes) 28

Grand Port.
- Rose Belle 29
- Plaine Magnien ... 30
- Mahébourg Hospital ... 31
- L'Escalier 32
- Bois des Amourettes 33
- St. Hubert... ... 34

Savanne.
- Souillac Hospital 35
- Rivière des Anguilles ... 36
- Chemin Grenier ... 37
- Baie du Cap ... 38

OTHER VILLAGES "proclaimed" for sanitary regulation are shown by a X.

Réunion, at that time a French possession, who brought their slaves with them and, as their enterprises developed, added to their numbers by purchase from abroad, principally Madagascar and East Africa. The conquest of the Island by and its ultimate cession to the British made little difference to the European resident population, who though they subscribed to the British oath of allegiance remained essentially French in their language, customs and outlook.

Economically Mauritius was a slave-owning Colony subsisting on agriculture. In 1835 slavery was abolished and the determination of the liberated negroes not to work on the land created an economic crisis which was only relieved by the importation from India of labourers for work on the estates under a system of indenture. It was not, however, until about 1843–44 that the labour problem was satisfactorily solved by the institution of regular arrangements whereby some 6,000 persons were admitted annually from India to undertake on indenture the agricultural labour so distasteful to the negro.

Those events have given the population its present mixed character. There were 392,938 persons enumerated in the Colony during the census of 1931. Of these 268,349 were of Indian race, 8,923 were Chinese, and the remainder, 115,666, comprised all persons in the Colony not acknowledging Indian or Chinese race. Among this number were some 10,000 indigenous whites, the remainder being either of pure African race or of mixed blood.

The composition of the population and a knowledge of their various occupations give a pretty good indication of what may be expected in the way of sanitation. The standards vary from the very high personal standards of some of the European inhabitants to the kind of thing experienced sanitarians have come to regard almost with despair as the sanitary standards of rural Asia. Since, however, the public hygiene, by which is meant the cleansing of the public thoroughfares and the general upkeep of public services, has always been in European control the superficial impression made by the Colony is one of cleanliness. It is only when one studies the habits of the people, the diseases from which they suffer, and the domestic environment in which the majority pass their lives that one realizes how far the personal hygiene of most of the inhabitants falls behind the standard set by the public authorities and the imposing volume of sanitary legislation enacted by the Legislature.

The main industry of the Colony is the production of sugar and the principal occupation of the population agriculture. Most of the Indian population are agriculturists. The Africans and those of mixed race find employment as artisans, skilled non-agricultural labour, and fishermen. The professions are open to all races and contain worthy representatives of various elements of the population.

For many years the labouring population lived on the sugar estates in quarters provided by their employers. Employers of resident labour were, and still are, required to provide free medical attendance and hospital accommodation as prescribed by statute. In spite of these advantages there has been a gradual drift of labour from estates to villages or small holdings, although these have mostly been established in the agricultural areas. The population of the rural districts is predominantly Indian, except for small fishing villages situated at certain parts of the coast. The African population apart from those inhabiting the fishing stations, tend to be town dwellers since their work

is largely in connexion with housing and occupations in which machinery figures.

An agricultural community is always liable to fluctuations in prosperity. The bigger the community and the more diverse its agriculture the more do those fluctuations tend to be smoothed out, because conditions affecting one crop may not always affect the others in the same way. When the community is a small one and its livelihood depends upon one single agricultural product it is exposed to the full impact of economic fluctuation, and this has always been the condition of Mauritius. Throughout its history it has experienced great fluctuations in prosperity but perhaps none so great as that seen after the conclusion of the war of 1914–18. Between 1917 and 1923 the Colony was more prosperous than it had ever been. From 1923 onwards the economic position gradually deteriorated until it reached a point where in the absence of assistance from the Imperial Government the sugar industry of Mauritius, in common with that of other colonial possessions, could not have survived. As it is, the industry has long since used up the reserves it accumulated in the years of plenty and it is now only able to survive through the preferential tariff accorded it by the British Government. The economic situation did not become really acutely bad until 1929–30, but the signs of an approaching depression were plainly evident before then.

When I assumed the administration of the Medical and Health Department in December 1927 the Department had attained proportions out of all relation to the future budgetary prospects of the Colony as a whole. Moreover, it was not efficient. The years 1921–25 were years of great prosperity for the administration as well as for the Colony. More services were demanded of the administration than it could be expected to fulfil. During the war great difficulty had been experienced in the recruitment of staff and a severe epidemic of influenza in 1919 had dealt it a severe blow. Bubonic plague reappeared in Port Louis, the capital, in 1921 and spread inland. Emergency measures had to be taken by the Medical and Health Department and a staff had somehow to be recruited. There was little wonder that much of the Department was unbalanced, expensive and unsatisfactory. The Department in fact, encouraged by the Legislature, had bitten off much more than it could chew. The only motive power that could keep it running was lavish expenditure.

In 1927 the Departmental organization conformed in the main to the principles then generally operative of having a Medical and a Sanitary Branch. There was also a central laboratory which served both branches. The administrative unit of the Colony was the district, of which there were nine. The district of Port Louis comprised the town of Port Louis and the neighbourhood. It was about 16½ square miles in area and contained nearly 55,000 inhabitants. The district of Plaines Wilhems was the central district of the Colony, lying mostly at a height ranging between 1,000 and 1,800 feet above sea level, and having a population of over 95,000 inhabitants, who were mainly resident in a string of villages and townships extending from Curepipe in the south (altitude about 1,500 feet) downwards along the main Port Louis-Mahebourg Road to Beau Bassin (altitude 600–1,000 feet) in the north. Port Louis was essentially a town which could be administered with the usual urban type of sanitary department and, though Plaines Wilhems occupied 78½ square miles, most of its problems were those of a semi-urban area. Moreover it was the residential district of

the European and the more prosperous members of the other elements of the population, whose sanitary practice was appreciably different from that of the majority of the 243,000 inhabitants of the other seven districts, known locally as the rural districts.

There were three hospitals in the Colony equipped as general hospitals—the Civil Hospital, Port Louis, containing some 300 beds, the Victoria Hospital, Quatre Bornes, in the district of Plaines Wilhems, having 270 beds, and a small but well equipped hospital at Moka, having a capacity of 80 beds.

The Departmental organization in the rural districts was as follows :—

In each rural district with the exceptions of Black River, which fed the Victoria and Civil Hospitals, and Moka, the hospital of which was equipped as a surgical unit, there was a small district hospital maintained by the Government. The number of beds in the district hospitals varied between 80 and 100, more or less according to the size of the district population. Associated with the district hospital was a number of dispensaries each with a trained hospital orderly (Dispenser) in residence. A whole-time Government Medical Officer was employed. He resided in the district and his duties were (*a*) the administration of the district hospital ; (*b*) twice-weekly consultations at the Dispensaries ; (*c*) Police Surgeon for the district ; (*d*) Public Vaccinator for the district ; (*e*) Medical attendant to a certain number of resident Government officials. In addition to these duties the Government Medical Officer was also the officer responsible for the district administration of poor relief. The Dispensers in charge of the Dispensaries assisted the Government Medical Officer in the poor relief work by keeping the records of paupers and generally acting as poor law clerks. In some areas they also fulfilled the duties of postmaster and Civil Status Officer (Registrar of Vital Statistics) as well.

Each district had, in addition, a resident staff of sanitary subordinate officers controlled by two Medical Officers known as Sanitary Wardens. One had charge of the northern districts of Pamplemousses, Rivière du Rempart and Flacq ; the other of the districts of Moka, Grand Port and Savanne. The sanitation of the district of Black River was controlled by the Medical Officer in charge of the police and prisons in Port Louis, who also visited the five dispensaries in the district twice a week.

I had studied this organization carefully during the year in which I held the acting appointment of Director of the Department and had formed the opinion that it contained a number of undesirable features. So far as the medical staff were concerned, much of their time was absorbed with poor relief work which could have been done equally satisfactorily by laymen. In the majority of cases the applicants for relief were persons quite incapable of earning their living because of their bodily infirmity, and it did not need a medical officer to conduct the exhaustive enquiry directed to ascertain whether or not they had relatives able to support them.

On the sanitary side the Sanitary Wardens could give only part of their time to their districts. They were not resident in them and much of their time was spent in proceeding daily between their spheres of operations and their homes. The sanitary subordinate staff were left a good deal too much to themselves. This is seldom healthy in a place where the attitude of the inhabitants when brought into direct contact with the representatives of authority, be it sanitary or other, is one of nervous propitiation.

In their relations with the public the sanitary staff were as unwelcome as the medical staff were appreciated. Yet these officers merely represented different aspects of the Department's activities for the general well-being of the community.

A consideration of the diseases of public health importance in the rural districts reduced them to four: malaria, ankylostomiasis, venereal disease and tuberculosis. A good deal of the recorded anaemia was probably secondary to malaria or ankylostomiasis, while much of the nephritis, which was fairly prevalent, could be ascribed probably to malaria. These four diseases have this in common, that simple hygienic measures can be relied upon for their prevention, that their epidemiological features are well known, and that dispensary work forms a very effective method of dealing with them, because though their ultimate control rests finally with the individual, much useful preliminary work can be carried out by the State, and the dispensary is one of the best means by which this may be done. In view of all these considerations it appeared to me, therefore, that in order to devise a cheap and effective instrument for the control of these infections it was necessary to consider the problem afresh.

Other factors had to be considered. The most important was the means whereby some of the appreciation manifested on account of the Department's therapeutic activity could be placed to the credit of its sanitary endeavour. Another was how to stimulate some kind of interest in the rural dweller in the preservation not only of his own health but also in that of his children. In a communication to the Government on this subject I wrote as follows :—

" I have already remarked in the Council of Government that there is a very definite limit to the amount of control which can be exercised by a Health Authority over a communicable disease. Beyond this limit the health campaign must be carried by individual effort. To get the fullest benefit from whatever action the local authority may take, the private citizen must himself contribute to the campaign. His contribution is the intelligent exercise of personal hygiene.

" The exercise of personal hygiene implies that the citizen has some knowledge of matters affecting his health. It also implies that he appreciates the importance of taking active steps to preserve his health, so far as these lie within his power. Unfortunately, at the present time the rural dweller knows little and appears to care less about those things. But unless he is brought to realise their importance and is given the instruction which will enable him to co-operate with the health authority little progress can be made, whatever the health authority may attempt. Who is the best person to impart this instruction to him ? It must be someone in whom he has trust and preferably to whom he is bound by some tie of gratitude.

" It appears to me that the person most likely to have these qualities is the doctor who attends him when he is ill. Another consideration which leads me to the same conclusion is this : the healthy human being has an instinctive disinclination to think about his health ; the convalescent patient, on the other hand, evinces what is sometimes a morbid interest in the subject. It seems to me, therefore, that the physician is the person best qualified to impart the necessary instruction, for he not only has the confidence of the convalescent patient and his friends but he has also the opportunity to instruct the patient in the art of keeping well at the time when the patient is in his most receptive mood.

" These considerations lead me to the conclusion that the health work of the rural districts should be carried out under the direction of Medical Officers, whom we may term Health Officers, undertaking medical and sanitary duties in that form of activity known as the practice of preventive

medicine. To assist the health officer in his work he will be given medical and sanitary subordinates assembled in a unit known as a Health Unit. The headquarters of each Health Unit would be located in a building or group of buildings known as a Health Centre."

The district health unit would therefore consist of the District Hospital and a number of satellite health centres each with its appropriate staff. In Mauritius I formed the opinion that one Health Officer could exercise adequate supervision and control of five health centres as a maximum as well as the administration of the District Hospital and the treatment of the patients therein. The District Hospitals are not intended nor are they equipped for major operative surgical work. This is done in the Civil, Victoria and Moka Hospitals, to which District Hospitals refer their serious cases. No health centre would be more than ten miles from the District Hospital, in the neighbourhood of which the Health Officer would reside, and as there were excellent roads linking up the different units of the proposed system the programme laid down was well within the capacity of a fit and energetic officer supported by a well trained subordinate staff. But it was essential for the proper operation of the system that the officers should be relieved of the poor law work, so as to have their whole time available for their professional duties. When the system was in full operation the subordinate personnel of each health unit would be a Sanitary Inspector, a Health Visitor, a Midwife and a Dispenser. The duties laid down for these officers were as follows :—

The Sanitary Inspector would concern himself with such matters as the prevention of mosquito breeding, domestic hygiene, the supervision of the sanitary services in the areas of the health centres and the administration of the sanitary law which included practically every form of sanitary activity in his area.

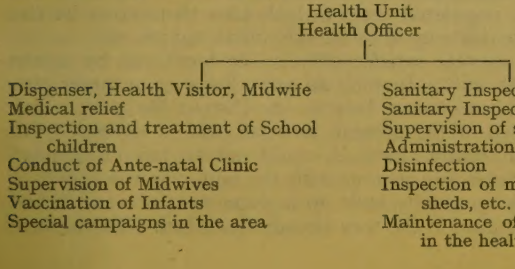
The Health Visitor's duties would be to supervise the work of the Midwife, visit the mothers of newly-born babies and keep in touch with the children, act as school nurse, see that the instructions of the Health Officer regarding the care and treatment of the school children were being observed, attend at the ante-natal clinic and generally carry out such other duties as the Health Officer may require.

The Dispenser's work would be to dispense and distribute medicine and undertake simple treatment under the direction of the Health Officer and to co-operate with the Health Visitor and the Sanitary Inspector in the work of the unit.

The duties of the Midwife need no special reference.

All subordinate officers of the unit will be expected to keep the records of their respective branches under the general supervision of the Health Officer.

From the above the work of the unit may be deduced. It may be summarized graphically as follows :—



The following accommodation was recommended for each Health Centre :—

Pharmacy—

Two small rooms containing two beds each for the reception of patients awaiting transport to the District Hospital.

Health Officer's room for the examination of patients.

A general purposes room for the ante-natal clinic, dressing of wounds and minor surgical work.

Two store rooms : One for the Dispensary and one for Sanitary Stores.

One office room to be shared by the Sanitary Inspector, Health Visitor and Midwife.

A four-roomed house for the Dispenser.

The memorandum embodying the gist of these recommendations was submitted to the Commission, among whose members it caused a good deal of discussion. Circumstances necessitated at a later date the elaboration of the proposals to the Government, and while I was engaged on this it struck me that this type of organization might be found suitable in rural areas of other tropical countries. I accordingly included a short account of it in my book published in 1931 (Kirk, 1931).

The Health Unit System appears to me to have many solid advantages. It can be instituted in a very small way and gradually and unobtrusively built up as trained personnel and funds become available. In most British territories in the tropics the nucleus is already there in the system of rural dispensaries or sub-dispensaries which has been established as an integral feature of the administration. These can be expanded into Health Centres without greatly modifying their character, in fact the expansion will come as a phenomenon of the normal evolution of such institutions. The population therefore are not faced with the appearance of something unfamiliar to them. It can be extended almost indefinitely without losing its fundamental character and new areas incorporated within its jurisdiction without fuss. Since the groups of centres function directly under one Health Officer, correspondence is reduced to a minimum ; information is received directly by the man who has to act upon it and in this way the interval between the occurrence of an event and the execution of the appropriate action is reduced as far as it is humanly possible to do so. The only disadvantage I can see is that the fundamental principle underlying its adoption is the prosecution of intensive preventive medicine in restricted areas. For Mauritius I recommended that the Health Unit should work in an area of about two or three miles radius, because no rural collection of dwellings exceeds this, which might be too small elsewhere. But I think the disadvantage implied in this limitation is more apparent than real. It is becoming increasingly evident that man's chief danger is man himself and that the closer he herds the greater is this potential danger. We may therefore safely leave the intervening sparsely populated areas to look after themselves for the time being and concentrate upon the closely inhabited places.

The system may operate satisfactorily in big territories by means of a travelling health unit. In such an area, however, a larger professional staff would be necessary because the District Hospital, which is always the nucleus of the system, however widely separated are the tributary health centres from it, could not be left unattended while the Health Officer was on tour with the unit. In the course of time centres could be gradually built up in populous parts and linked with the District Hospital in the way already described. The work of

the unit would then become static instead of peripatetic, but it should retain its dynamic character.

Others were being gradually faced with the same problem which I had attempted to solve as described. In September 1930 the Spanish Government proposed to the Council of the League of Nations that the League should convene at Geneva a conference of representatives of European States for the purpose of a technical international study of rural hygiene. This proposal was adopted and the Committee appointed by the League for this purpose issued its report from Geneva on July 31st 1931, (League of Nations. 1931). The first volume of the report contains the Committee's recommendations, and when I read it I was struck by the remarkably close resemblance between the arguments adduced by the Committee and those submitted by me to the Mauritius Government. The similarity of the conclusions reached was also noteworthy. There were naturally differences in detail owing to the differences in the status of the inhabitants in the areas under consideration and of the forms of Government, but the principles laid down were in complete accord.

In their description of the Rural Health Centres the Committee wrote " The Rural Health Centre may be defined as an institution for the promotion of the health and welfare of the people in a given area, which seeks to achieve its purpose by grouping under one roof or co-ordinating in some other manner, under the direction of the Health Officer, all the health work of that area. . . ." There is no essential difference between this and what I have already mentioned above— " These considerations lead me to the conclusion, etc." The Committee emphasized that the rural health centres constitute an integral part of the general health organization, as I myself had done. For the subordinate staff of the Health Centre the Committee recommended a Health Visitor, Sanitary Inspector and Midwife. Under the European scheme the Health Visitor would combine the duties I had allocated between the Health Visitor and Dispenser. It should be remembered that the European population could get their medicines in pharmacies, which do not exist in tropical rural areas.

In November 1932 an International Conference of Representatives of Health Services of certain African Territories and British India was held at Cape Town (1933). Among the numerous subjects studied by the Conference was Rural Hygiene. The Conference stressed the inadvisability of separating preventive from curative medicine in so far as the personnel which comes in direct contact with the common people is concerned. This was an important consideration, which led me to advocate the Health Centre System, but I have the feeling that the Conference went rather too far when they suggested that " The dispenser should be given a little more instruction in public health and the Sanitary Inspector a little more instruction in treatment." I do not consider this to be a good policy. It must be remembered that the subordinate staff of a health unit are being taught something entirely unfamiliar and it is therefore advisable that the training should be clearly focussed on what they will be expected to do every day. By all means give the Dispensers a preventive outlook during their training in diagnosis and therapeutics and let the Sanitary Inspector know whether or not the diseases with which he will have to deal are capable of responding satisfactorily to treatment, but I think it better to keep their functions separate though encouraging them in the closest co-operation.

In response to a number of private enquiries I contributed an article in 1934 in which I briefly described my conception of the system in its fully developed form (Kirk, 1934). The main administrative unit was the Provincial Unit, which consisted of the Provincial Hospital which would bear the same relation to a number of District Hospitals as the District Hospital bore to its Health Centres. The Provincial Hospital would be a large hospital equipped for modern medical and surgical practice. It would also act as the training depot of the subordinate staff. There would also be the Provincial Laboratory, Sanitary Engineering Department and Epidemiological Bureau. The Provincial Unit would have its own staff of administrators and specialists and would deal with the Headquarters of the Government Health Department.

It is difficult to indicate the optimum areas to be served by the Health Centres, District Units and Provincial Units, because so much depends upon the density of population, means of transport and the type of country which is to be worked. In Mauritius the administrative District was a convenient District Unit, averaging a population of about 30,000 persons, and an area of between 60 and 100 square miles, a good deal of which is under timber and is not inhabited at all. The Colony itself with a population of nearly 400,000 and an area of 720 square miles constituted what would be the provincial Unit in a larger territory.

For backward rural areas the Health Centre System is certainly more economical in professional staff than in the type of administration based on a separation of therapeutic and sanitary activities, and for many years to come it looks like being the optimum type of administration for such areas. It is possible that as prosperity comes to these regions, the population increases, and a higher standard of living becomes established, the Health Centre type of administration may become inadequate and another form of administration devised based once more on the separation of curative from preventive medicine. But such a contingency is unlikely to arise for a great number of years unless there is a radical change in the educability and the hygienic practice of the tropical rural equivalent of the man in the street.

The appearance of the League of Nations report to which reference has already been made, was followed by a reference to the Health Centre System in the Annual Report of the Medical Department of Kenya Colony for the year 1933. This report detailed the chief objects of the Field Medical Services in the Native Reserves and went on to state that "with a view to the achievement of these objects, which clearly require for their fulfilment the closest of contact between the Medical Service and the community, the district medical organisation of Kenya has for many years past been developed according to a system which has recently been given prominence in an important publication of the Health Organisation of the League of Nations—the system of a Central or 'Secondary' Health Centre in each district governing and working through a series of subsidiary or 'Primary' Health Centres." (Paterson, 1935). It would appear, however, that the Health Centre idea had never been clearly formulated and made known to other neighbouring Colonies, for we find that when Uganda was faced with the same problem it approached it in much the same way as I had done in 1927. In the Annual Report of the Medical and Sanitary Department for the year 1933 we read the following :—" The

problem therefore arose as to how best to provide for improved health services with the limited staff and money available. The first step was the diversion of the activities of the Medical Officer from purely curative work to include the development of rural sanitation in his district, particularly in the areas immediately surrounding the sub-dispensaries, which lent themselves to a ready conversion into health centres inasmuch as the curative medical work carried out in them during the past few years had secured the confidence of the neighbouring population." (KAUNTZE, 1934).

In Mauritius the difficulty of devising suitable alternative means of relieving the Medical Staff of poor relief work has hitherto prevented the establishment of the Health Unit System. But this year a trial is being given in the district of Plaines Wilhems to a new system for the administration of poor relief in the Colony, and if the trial proves successful the system will be applied next year throughout the Island. The relief thus afforded to the Medical Staff will enable the establishment of the Health Unit System in a more complete form than has hitherto been possible. The first step has already been taken for some years by the abolition of the posts of Sanitary Wardens and the assumption of preventive duties by the District Medical Officers who have taken over the control of the Sanitary Staff. Further than this it has not yet been possible to go.

For the first detailed account of a Health Unit in action credit must be given to Uganda. HOOPER and LOEWENTHAL (1936) have recently published an interesting account of the working of such a Unit in the Teso district of Uganda. This district extends over an area of some 4,000 square miles and contains a population of 295,000, mostly Africans together with a handful of Europeans and Asiatics. For this population there has been provided the following staff, admittedly inadequate, but undoubtedly making their presence felt :—

1 European Medical Officer, 1 European Nursing Sister, 1 European Sanitary Inspector, 1 Indian Sub-Assistant Surgeon, 1 Senior African Medical Assistant, trained male and female attendants at the district hospital, 2 African Midwives, 1 trained Laboratory Assistant, 2 Mosquito Searchers, 6 Sanitary Orderlies.

The administrative headquarters are situated in Soroti, which is the principal town of the district. The district hospital is situated there. There are apparently four sub-dispensaries in the rural areas, which are now being developed as Health Centres. The reader should consult the original paper for details, and not the least interesting feature of it is the evidence of the enthusiasm of the staff for the new arrangements.

JACOCKS (1933) has written an interesting description of the system adopted in Ceylon. The Ceylon Health Unit, however, differs fundamentally from the system with which this account is concerned in that it is the familiar urban type of health administration modified to suit rural conditions. He states " The object [of the health unit scheme] is to bring to rural areas the benefits of health protection which are now enjoyed by large towns and cities. This end is accomplished by dividing rural areas into suitable districts and introducing therein small but completely trained bodies of workers who remain permanently in the delimited area and undertake all public health problems. Their activities embrace health education, general sanitation, collection, tabulation and study of vital morbidity statistics, control of preventable endemic and epidemic diseases, vaccination and preventive inoculation,

maternity and infant welfare work, school health work, and adult hygiene." Jacocks states that more than 600 of these organizations are now functioning in various countries in Europe, Asia and America.

It will be seen from the preceding paragraph that general medical care of the population is outside the sphere of the health unit which doubtless works in close collaboration with, but quite distinct from, the purely medical organization. It is in this respect that the Ceylon Health Unit differs from the type evolved in Mauritius and in tropical Africa. The Ceylon Health Unit designed for a population of about 80,000 has the following staff: 1 medical officer of health, 1 clerk, 5 sanitary inspectors, 6 midwives and a number of minor employees, part of the expenditure being borne by the Central Government and part by the local authorities comprised in the area of operations. In the densely populated parts of the world in which this unit has been evolved such an organization is undoubtedly effective. But in the vast sparsely populated areas of tropical Africa it is doubtful if this type of organization could effectively deal with such numbers. The distances to be traversed would alone present an almost insuperable obstacle to effective activity to what appears to be a highly centralized and therefore somewhat rigid type of administration. The Mauritian system of health units has the merit of being able to be expanded almost indefinitely without losing its fundamental character or its effectiveness. Perhaps in actual operation the difference would be more apparent than real but from the theoretical viewpoint the Mauritian system appears more suited to sparsely populated countries than the Ceylon system.

It is hoped that this account of the evolution of a system of rural sanitation will be useful to other administrations faced with the same problems as those described. The writers of administrative reports are apt to take much of their organization for granted and to assume that other administrations are working on more or less the same lines. A striking example of this has already been quoted regarding Kenya and Uganda, two neighbouring colonies in close administrative touch with one another. One had already solved its problem; the other, apparently in ignorance of this, was obliged to reason out its own solution from first principles.

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TRYPANOSOMIASIS.

British East African Territories, Conference of Governors of: **Research Conferences. Conference on Co-Ordination of Tsetse and Trypanosomiasis (Animal and Human) Research in East Africa held at Entebbe, 29th to 31st January, 1936.**—87 pp. Nairobi: Govt. Printer.

After some introductory remarks by the Governor of Uganda, the Conference proceeded to consider the progress made in the Programme of Research drawn up at the 1933 Conference [this *Bulletin*, 1935, Vol. 32, p. 12.] A number of progress reports were before the Conference; these are printed in a series of Appendices at the end of the Report.

The conclusions reached from the discussion of the 1933 Programme are briefly as follows:—

ii.—*Question of natural immunity, spontaneous cure and acquired immunity in man.*—It was decided that although every opportunity should be taken to pursue investigation of these points, the item should not be included in the programme of research.

iii.—*Experiments on relatively resistant ruminants with strains of T. rhodesiense and T. gambiense obtained over as wide an area as possible.*—After discussion, in which Hornby, Mettam, Bennett, Potts and Kennedy took part, the Conference agreed:—

"(1) that the strains of *T. brucei* and *T. rhodesiense* used at the Entebbe Veterinary Laboratory should be sent to the Veterinary Laboratory, Mpwapwa, and to Dr. Bennett in the Sudan for testing on the cattle in those areas;

"(2) that further experiments should be carried out at the Entebbe Veterinary Laboratory to determine whether or not Zebu cattle were more resistant to infection with *T. brucei* than cattle of the Ankole type;

"(3) that the possibility of transmission of *T. brucei* and *T. rhodesiense* to cattle by *G. palpalis* should be studied at Entebbe.

iv.—*Existence of other reservoirs than man of T. gambiense and T. rhodesiense.* Corson stated that he had passed *T. rhodesiense* through various animals, and had shown that over a long period no change of virulence had taken place. Fairbairn considered that there was a possibility of the existence of another reservoir than man for *T. rhodesiense.* The Conference agreed:—

"(1) that the work at the Tinde Laboratory on the existence of other reservoirs than man of *T. rhodesiense* should be continued;

"(2) that it is important to examine the possibility of the existence of other reservoirs than man for *T. gambiense*, although with the present facilities for laboratory work in East Africa this investigation cannot be undertaken at the moment."

v.—*Retention of acquired characteristics of trypanosomes during cyclic evolution in the body of the tsetse fly.*—After considerable discussion it was agreed:—

"(1) that the influence on the virulence of *T. gambiense* of repeated passages through *Glossina morsitans* and monkeys, which has been carried on at Tinde Laboratory, should be continued;

"(2) that it was of great importance that investigation of the question of arsenic resistance in different strains of *T. rhodesiense* and *T. gambiense* should be further investigated. The Conference understood that if it could be arranged this would be carried out in the Tanganyika Territory."

vi.—*Evolution of different trypanosomes in body of tsetse and other biting flies and relationship to environment (climate, etc.) of cyclic transmissibility and pathogenicity.*—A paper by Lamborn on this subject (Appendix xii) was considered and the matter was discussed by Mettam, Hargreaves, Hornby and Hart. The Conference agreed that in view of the absence of evidence of cyclic transmissibility in biting flies other than tsetse this investigation should be deleted from the programme of research.

It was decided to consider together the following items of the 1933 programme :—

vii.—*Biological studies of tsetse flies in T. rhodesiense, T. gambiense and T. brucei areas.*

vii.—*Study of food supply of tsetse as determined by the biological study of stomach contents of fly.*

xiii.—*Control of tsetse fly.*

xviii.—*G. palpalis.—Bionomics, food of, trapping, and size of barrier clearings.*

Four papers on these subjects were before the Conference, *viz.*— Appendix iii by the Director of Medical Services, Uganda ; Appendix v by The Director of Veterinary Services, Uganda ; Appendix ix by E. A. Lewis of the Veterinary Research Division, Kenya ; and Appendix xiii by the Tsetse Research Department of Tanganyika. After a lengthy discussion of these matters it was resolved that :—

" The Conference, having heard the details of work on tsetse bionomics and control carried out during the past two years, considered that study should be pursued along all these lines, special attention being directed to trapping, the use of chemical baits in traps, and the influence of changes of physical environment under laboratory and field conditions. It also recommended that, in view of the short time the work in the Lambwe Valley had been in hand and its great importance, it should be continued at least until the next meeting of the Conference.

" The Conference noted the value of work carried out by Dr. Mellanby at the Human Trypanosomiasis Institute, Entebbe. It regretted that owing to the expiry of his grant he was compelled to return to Europe, but hoped that efforts would be made to ensure continuance of investigations on the lines on which he has been working."

ix.—*Investigation of the prophylactic value of Bayer 205.*—The Chairman read an extract of Duke's papers on this subject which appears as Appendix xiv. In the discussion which followed, Fairbairn, commenting on Duke's statement that cryptic infections may occur after the use of Bayer 205 as a prophylactic, stated that he had never yet seen cryptic infections caused by *T. rhodesiense.* The Conference noted the important observations recorded by Dr. Duke on the prophylactic use of Bayer 205, but while recognizing its value considered that the question of cryptic infections should receive further investigation ; it believed it advisable to await the result of further field experiments in Uganda and elsewhere before advocating the use of Bayer 205 as a prophylactic agent on a large scale.

x.—*Further investigation of identity of T. uniforme.*—Three papers on this subject were before the Conference, *viz.* Appendices ii, iii and iv. The Conference agreed that this question should be investigated as and when opportunity permits.

xi.—*Investigation of bionomics of T. brucei.*—After discussion the Conference recorded the desirability of further investigation of the point, but did not consider it could be included in the current programme of research.

xii.—*Cultivation of T. congolense and T. vivax on artificial media.*—It was agreed that this item should be deleted from the research programme.

xiv.—*Trypanosomiasis of pigs.*—Reference to this subject is contained in Appendices ii, iii and iv. After some discussion it was decided to delete this matter from the programme of research.

xv.—*Course of T. rhodesiense infection on the larger antelopes.*—It was considered that this subject had been covered during the discussion in Item iii.

xvi.—*Pathology of Rhodesian sleeping sickness.*—A memorandum on this subject by Dr. Calwell is contained in Appendix xi. In the discussion on this paper Fairbairn stated that he thought it unlikely that material for pathological investigation would be available from untreated cases of sleeping sickness. The Conference emphasized the importance of the investigation of the pathological anatomy of cases of trypanosomiasis, both animal and human, and recommended that arrangements should be made whereby workers on trypanosomiasis could be put in touch with experienced pathologists in Europe who would be prepared to undertake the investigation of post-mortem material.

xvii.—*Infectibility of G. brevipalpis with T. rhodesiense.*—The Conference noted Dr. Calwell's work (Appendix x) on the infectibility of *G. brevipalpis*, and understood that an endeavour would be made to carry out further investigations along these lines in the coastal areas of Tanganyika.

The Conference then turned to a consideration of a number of items not in the Agenda. These were :—

1. *Chemotherapy of animal trypanosomiasis.*—Several papers dealing with this matter were before the Conference, *viz.*, Appendices ii, iii, iv, vii and viii. Mettam, Daubney, Hornby and Bennett took part in the discussion, and it was decided to record that the Conference noted the work which had been carried out since the last meeting of the Conference, and considered that, in view of the success which has attended tests of Surfen C. in *T. congolense* infections, further investigations of trypanocidal compounds should be made, and that this drug particularly should receive further study.

2. *Examination of resistance to human serum* in vitro *of T. brucei and T. rhodesiense.*—The Conference recommended that in view of the fundamental importance of devising a method of differentiating *T. brucei* from *T. rhodesiense*, experimental work be carried out to determine the resistance to human serum, using Warrington Yorke's *in vitro* technique, of a large number of strains of *T. brucei*. Such work would necessarily be conducted in a *T. rhodesiense*-free country. The Conference suggested that Zululand might prove suitable for the purpose. It further recommended that the possibility of the work being put in hand be examined by the Tanganyika Government.

Other matters discussed were :—The transmission of *T. congolense* by *G. palpalis* ; The influence of the plane of nutrition on trypanosome infection ; Animal reservoirs of *T. rhodesiense* ; and Distribution of reports. With regard to the last item the Conference agreed to recommend :—

" (1) That the Governors' Conference be approached with a view to the establishment of machinery for the circulation of reports in connection with Human and Animal Trypanosomiasis throughout the East African Territories and the Sudan.

" (2) that heads of departments should be requested to circulate information to other East African territories at regular intervals, giving the names of officers conducting investigations in their departments."

The delegates then considered the question of the period which should elapse between meetings, and as the result of their deliberations :

" The Conference recommended that meetings should be held at two-yearly intervals and that the next one should be held in Tanganyika Territory in association with that on the Co-ordination of General Medical Research.

" The Conference agreed that the arrangement of the agenda for the next meeting and the collection of progress reports should be left to the Advisory Medical Research Committee—suggested by the Conference on General Medical Research (if appointed)—and to the Co-ordinating Committee on Veterinary Research, liaison being maintained with the Tsetse Research Department, Tanganyika."

Summary of programme of tsetse and trypanosomiasis research, 1936–37.

Item of Research.	*Where to be carried out.*
1. Testing of the Entebbe Laboratory Strains of *T. brucei* and *T. rhodesiense* for Infectivity to Cattle	*b* and *d*
2. Relative Resistance of Zebu and Ankole Types of Cattle to *T. brucei*	*a*
3. Transmission of *T. brucei*, *T. rhodesiense* and *T. congolense* to Cattle by *G. palpalis*	*a*
4. Existence of Other Reservoirs than Man for *T. rhodesiense*	*c*
5. Retention of the virulence of *T. gambiense* after Transmission by *G. morsitans* in Monkeys	*c*
6. Arsenic Resistance in Strains of *T. rhodesiense* and *T. gambiense*...	*c*
7. Bionomics of Tsetse Fly	Work now carried on in various Territories to be continued.
8. Control of Tsetse Fly	Ditto.
9. Field experiments on Bayer 205 Prophylaxis	*e*
10. Infectibility of *G. brevipalpis* with *T. rhodesiense* ...	*f*
11. Investigations on Trypanocidal Compounds	*a* and *b*
12. Differentiation of *T. brucei* from *T. rhodesiense* by resistance to Human Serum *in vitro*	*f*
13. Influence of Plane of Nutrition on Trypanosome Infections	*b*

a—Veterinary Laboratory, Entebbe.
b—Veterinary Laboratory, Mpwapwa.
c—Trypanosoma Rhodesiense Laboratory, Tinde.
d—Veterinary Department, Khartoum.
e—Uganda Medical Department.
f—Tanganyika Medical Department.

W. Yorke.

GILKES (Humphrey). **The Investigation of an Outbreak of Sleeping Sickness in Northern Rhodesia.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. July 31. Vol. 30. No. 2. pp. 213–222. With 1 map.

——. **Sleeping Sickness in the Mumbwa District.**—*Northern Rhodesia Med. Rep. on Health & Sanitary Conditions for Year 1935.* Appendix I. pp. 31–38.

This investigation concerning the incidence of sleeping sickness in the Hook of the Kafue River was undertaken in order to answer certain questions raised by the district administration.

The area in question lies to the west of the Livingstone-Broken Hill Railway and is bounded on the north, west and south by a hook which the Kafue river makes before it flows eastward to the Zambesi. Mumbwa, the seat of administration, lies at the centre of the hook; it is a little over 100 miles from Mumbwa to the tip of the salient.

As is shown in an accompanying map the northern part of the hook is a game reserve, though scattered villages were situated there at the time of the investigation; the southern half is a native reserve. It is proposed to build a road from Mumbwa to the tip of the salient and aerodrome, running between the game reserve and the native reserve, and it is intended that the villages of both Area I and Area II (in the game reserve) shall be moved into new sites in the native reserve.

Reports of suspected cases of sleeping sickness have been received from this district for more than 10 years. The year 1935 saw a great increase of such cases, but it was, for reasons stated, difficult to decide how many were really sleeping sickness. Therefore, with the exception of the small group of villages in Area I, in which 25 suspected deaths occurred during the year and in which the natives had obviously learned from experience of many cases, reports were not considered reliable.

The course of the journey made by the author is indicated by the dotted line on the map. Observations are recorded on the native tribes collected in this rather sparsely populated area, on the type of vegetation, and on the game and tsetse (*G. morsitans*). During 1935 there were 29 cases of the disease diagnosed microscopically; 9 were found during the investigation and the remaining 20 were diagnosed from slides of blood and gland juice sent for examination. The distribution of these cases is discussed in some detail. Examination of the recent movements of the cases suggests that the game reserve, and particularly Area I, is the original source of infection. The remedy appears to be the evacuation of the villages of Areas I and II combined with the usual grouping of the villages in contiguous areas, and clearing. After much deliberation by the chiefs, the Administration and the Medical Department, the areas marked IA and IIA were chosen as the new sites for the evacuated population.

The author answers the questions raised by the District Administration as follows:—

1. *The endemicity or epidemicity of the disease*:
The disease is endemic. It is carried by *Glossina morsitans*. Nine cases existed in the area in December, 1935.

2. *The liability of travellers to infection and the possibility of control of the routes*:
This liability will always exist, both for Europeans and natives. The worst routes for natives pass through the game reserve and these will automatically be closed by the removal of all the villages. The Government stations further west should warn natives of the disease, and tell them that there are now no villages in the game reserve and that the area is closed. No cordon is necessary as the disease is not an epidemic.

3. *The desirability of opening the game reserve as a tourist attraction*:
This would be wrong until at least 10 years have elapsed.

4. *The question of evacuating the native reserve also*:
This is unnecessary. The cases found in the native reserve were probably, though not certainly, infected in the game reserve. Sleeping sickness is now endemic in northern villages of the native reserve, but the measures suggested should keep it in check and it is hoped eventually to reduce it to a very occasional case.

5. *Consideration of the best areas to which the natives now in the game reserve should be moved* :

After considerable discussion the areas marked Area IA and Area IIA have been chosen as most suitable under the circumstances.

6. *The best position for a native dispensary* :

This has been sited at the Chief's village in Area IIA. It could be reached by a branch road.

7. *The native cotton industry* :

This will be unaffected, provided that the west road is built.

8. *The advisability of building this contemplated west road through the sleeping sickness area* :

There is no reason why a road should not be built. Its course was sited during the tour of investigation so that it would pass through no villages and avoid infected areas. It should prove of immense value to the whole district. If the question is asked " Is there any danger to the Europeans and natives who build it ? " the answer is " Yes," but they could be protected to a certain extent by prophylactic doses of Bayer 205 and suitable clothing. The native labour, could, moreover, be recruited locally and local natives would run no more danger than in their normal journeys from village to village. It is, of course, important to establish efficient fly-posts on the new road to prevent cars and lorries from carrying the tsetse fly into Mumbwa.

9. *The question of building an emergency landing ground and its best situation from the sleeping sickness point of view* :

This was sited near the pontoon which will carry the new west road over the Kafue River. A single village will be left there as caretakers of the river crossing. There have been no reports of sleeping sickness in this village and no cases were found there. There are no tsetse fly near and the surroundings of the village are clean and well cleared. *W. Y.*

Gold Coast: Report on the Medical Department for the Year 1935. Appendix IV. pp. 78–84.—**Report of the Committee on Human Trypanosomiasis** [Jackson (F. W. F.), Chairman].

The Committee was appointed by the Governor to discuss the problem created by the apparent increase in the prevalence of human trypanosomiasis. The terms of reference were :—

(*a*) To advise as to the best means of combating human trypanosomiasis.

(*b*) To consider the existing legislation on the subject and to advise whether any revision is necessary.

The report is divided into three parts, the first of which deals with general observations.

The Committee does not consider that the present situation throughout the Colony need give rise to undue concern. The disease is undoubtedly a drain upon the people and can, in certain circumstances, become dangerous, but there is, on the whole, no cause for panic. Although hospital figures show a relatively considerable increase in the number of cases treated, this does not necessarily mean that there has been a serious increase in the incidence of the disease among the people of the Gold Coast. There have, however, been isolated outbreaks in a few areas such as Mamprusi. Various factors explain the rise in number of cases treated, *e.g.*, better diagnosis, more efficient treatment, and greater confidence among the natives. The Committee stresses the need for gradual enlightenment of the African by means of persistent (not blatant) propaganda.

Notwithstanding the foregoing remarks there has probably in recent years been a slight increase in the prevalence of the disease. In the most seriously infected focus, which lies in the Northern Territories, the incidence varies between 4 and 10 per cent. In Ashanti the incidence is not so high, the percentage of infection in Northern Ashanti being about 0·6.

In the Northern Territories the usual vector is *G. palpalis*, although *G. tachinoides* is quite common. In the forest zone (Ashanti) *G. palpalis* is again the chief menace, but *G. longipalpis* is also found. The report then refers to such matters as clearing, legislation, treatment and trypanosomiasis of cattle.

The last two parts of the report are devoted to recommendations for dealing with the situation in the Northern Territories and in Ashanti, respectively. *W. Y.*

DUKE (H. Lyndhurst). **Studies of the Effect on *T. gambiense* and *T. rhodesiense* of Prolonged Maintenance in Mammals other than Man ; with Special Reference to the Power of these Trypanosomes to infect Man. I & II.**—*Parasitology.* 1936. July. Vol. 28. No. 3. pp. 381–390. [13 refs.] ; pp. 391–394.

Duke states that the main theme of this series of papers will be the power of the *brucei* group of trypanosomes, *T. brucei*, *T. rhodesiense* and *T. gambiense*, to infect man. This problem is bound up with two others of practical importance, *viz.* (1) Can the African big game serve as reservoirs for human trypanosomiasis ? ; and (2) What are the affinities existing among these three trypanosomes ? It is the author's intention to attempt to summarize knowledge on these matters and particularly to state as definiteiy as possible the position reached by the investigations carried out at his own Institute at Entebbe. The following subjects will be considered : *T. gambiense* in ruminant game ; the effect of prolonged maintenance away from man on the infectivity of *T. gambiense* for man. Similarly with *T. rhodesiense* ; the infectivity of wild *T. brucei* for man ; some observations on Bevan's " Kahondera " strain from Rhodesia ; and lastly a summary of the position as it appears to Duke.

The first paper of the series deals with the question of *T. gambiense* in ruminant game. After reviewing the very scanty literature on the subject (BRUCE *et al*, 1911, Duke, 1912 and 1928) the author describes certain recent observations made by himself in which 3 situtunga, 2 oribi, 1 reedbuck and a hybrid between bushbuck and situtunga were exposed to infection with *T. gambiense*. Of the 3 situtunga, one developed a transient infection, but the trypanosome failed to infect the glands of any of 1,068 *G. palpalis* which were fed on the situtunga ; the other two situtunga failed to become infected. Both oribi became infected and from one of these *G. palpalis* was infected ; the animals apparently did not suffer severely as the result of the infection. The reedbuck appears to have developed a temporary infection without any serious result, and the hybrid failed to become infected.

It is important to note that in the experiments cited in this series of papers the animals were infected, whenever possible, by cyclically infected *G. palpalis*, either directly by their bite or indirectly by the inoculation of the infected salivary gland.

These observations show that *T. gambiense* is but poorly adapted to life in the species of antelope chosen. Duke reaches the general

conclusion that *T. gambiense* in ordinary circumstances depends mainly on man and perhaps, but to a much less degree, on his domestic animals for survival in nature. It is most improbable that game animals are a danger in the spread of this trypanosome in nature. Even if *T. gambiense* infects these animals it is prone to lose quickly its power of developing in the fly.

In the second paper are collected all the instances recorded at the Entebbe laboratory of testing *T. gambiense* on man after the trypanosome had been maintained for a time in laboratory animals. The history of each of the strains tested is given.

The conclusions reached are :—

" Of 7 strains of *T. gambiense* tested in man after maintenance for various periods away from all contact with man, 6 retained apparently unimpaired their power of infecting him, although the number of volunteers employed with some of the strains was small.

" The seventh strain failed to infect on 3 occasions and with 3 different volunteers, but infected 4 others.

The Infectivity of " Wild " T. brucei *for Man.*

" The following is a brief summary of the tests carried out with *T. brucei* at the Entebbe Institute. Two new strains have been tested since the last publication on this subject.

" (1) *T. brucei.* Strain LVI (*a*, *b* and *c*) ; these 3 strains, recovered from wild *G. palpalis* on Damba Island, Lake Victoria, were tested on 4 volunteers (1 European and 3 natives). The men were exposed freely to laboratory-bred *G. palpalis* infective with these strains, and in no case did infection of man occur (Duke, 1935).

" (2) *T. brucei.* Strain LIII ; from the Kazinga channel in Western Uganda (*G. pallidipes*). A fly infective with this strain bit but failed to infect a volunteer.

" (3) *T. brucei.* Strain LV ; from the *G. morsitans* country in the vicinity of the Murchison Falls on the Victoria Nile, in the Northern Province of Uganda. Four gland-infected flies bit a volunteer but failed to infect him.

" (4) *T. brucei.* Strain LVII ; from the *G. pallidipes* country on the north-east shores of Lake Victoria. Flies infective with this strain failed to infect a volunteer.

" (5) *T. brucei.* Two strains recovered from a *G. palpalis*-infested shore-line of Lake Victoria, near Entebbe. The strains were obtained in monkeys by exposing the animals to the bites of wild tsetse. The citrated blood of these monkeys was then inoculated into a volunteer, who did not become infected. Control animals inoculated at the same time became infected with *T. brucei.*"

The paper ends with a summary of the tests carried out at the Entebbe Institute on the infectivity of " wild " *T. brucei* for man.

[For a more detailed account of most of the experiments mentioned in this paper see this *Bulletin*, 1935, Vol. 32, p. 688]. *W. Y.*

Duke (H. Lyndhurst). **Antelopes as Reservoirs of** *Trypanosoma gambiense.* [Correspondence.]—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. June 30. Vol. 30. No. 1. pp. 129–131.

This is a reply to Corson's recent letter on the subject of antelopes as reservoirs of *T. gambiense* [this *Bulletin*, 1936, Vol. 33, p. 667]. Duke writes that he himself, and not Bruce's Commission, must be held responsible for the final conclusions referred to by Corson. He is satisfied that there is no reason whatever to doubt the correctness of the earlier experiments, and that the investigation as a whole showed

that *T. gambiense* may survive for a long period in antelope. Duke states that he is reviewing the whole subject in a paper which is now in the press [*vide* above]. *W. Y.*

Lloyd (Ll.). **Assessment of a Tsetse Population.**—*Bull. Entom. Res.* 1936. July. Vol. 27. Pt. 2. pp. 261–267. With 1 fig.

In the experiments described in this paper *G. tachinoides* in an isolated secondary focus around the Road Pond at Sherifuri, Nigeria, were marked with distinctive colours during 13 successive weeks, and the fate of the groups studied by recaptures. On the first three days of each of the 13 successive weeks, collections of *G. tachinoides* were made in the secondary focus. At the end of each collection the flies were marked with a bold spot of oil paint on the dorsum of the thorax, and passed through a bung-hole into a large wooden box provided with a muslin cover. The box was then placed in a fixed spot in the thicket with the muslin cover darkened and the bung-hole open, so that the flies could find their way out. A distinctive paint was used each week, and flies caught bearing marks were released without further marking. The individual marked fly might thus be caught on several occasions, but the intention was to keep the colony as intact as possible. The fly boys were instructed not to collect in the immediate neighbourhood of the release, so that the marked flies recaught had again become part of the general population.

The fly population of the focus was known to be declining from moderate density to great scarcity through the dry season, and the wastage in the colour groups on the average proved to be 11·5 per cent. per diem; this was probably rather greater than the wastage in unmarked flies. Following Jackson's method of assessment the population was shown to fall from 6,000 at the end of October to 400 by mid-January. The ratio of the boy-hour rate to these numbers is worked out for each collection, and it is found that when the boy-hour rate is above 50 it is not relative to population, but below 50 the rate falls as the population, allowing for the influence of weather on rate of catching.

Under the conditions of the experiment, there was an almost complete change of fly population each 5 or 6 weeks, although an occasional fly may survive for 11 weeks. The population of male flies in the catches fell with increasing age from an initial 57 per cent. to 23 per cent. in the 6th week, and no male fly surviving this period was caught.

W. Y.

Roubaud (E.) & Colas-Belcour (J.). Observations biologiques sur les glossines (*Gl. palpalis*, *Gl. morsitans*). [**Biological Observations on Glossina** (*G. palpalis*, *G. morsitans*).]—*Bull. Soc. Path. Exot.* 1936. June 10. Vol. 29. No. 6. pp. 691–696. With 2 figs.

This paper records a number of observations made in the Institut Pasteur on *G. palpalis*, the pupae of which were sent by Duke by air mail from Uganda in mid-winter. The pupae were placed in an incubator with a moist atmosphere (70 per cent.) at a temperature of 25°–28°C. during the day, but sometimes exceeding 32°C. at night. A few hours after their arrival the pupae began to hatch. It was observed that about two-thirds (2,319) of the pupae failed to hatch, and that a large number (500) of liberated flies, which were not fully

developed, died immediately. Only about 250 pupae liberated normal flies which could be kept alive for some time. Among the 515 flies which failed to develop their wings and died almost immediately 149 (28·9 per cent.) were males and 366 (71·1 per cent.) were females; whilst amongst 58 flies which developed normally 40 (68·9 per cent.) were males and 18 (31·1 per cent.) were females.

These facts show that the female in the pupal state is much more sensitive to unfavourable conditions than is the male. The phenomenon is not peculiar to *G. palpalis*, but applies equally to *G. morsitans*. Flies were bred in Paris uninterruptedly for 3 years, but the process was finally ended by "spanogynie," or complete disappearance of the females, only males hatching from the pupae. The authors inquire whether this is not the explanation of the curious separation of the sexes which had been observed from time to time (Zupitza, Roubaud, Stuhlmann, etc.) in natural foci of *Glossina*, in which males were found almost exclusively.

The authors next pass to an examination of the factors which are responsible for the sterility of the females under unfavourable climatic conditions. Previous work has already shown that under the influence of abnormal thermic and hygrometric conditions there is retention of eggs in the ovary and premature expulsion of larvae. The present investigation showed, however, that another anomaly of a different kind also plays a part. This is the absence of fertilization, notwithstanding frequent couplings. The failure of fertilization is perhaps due to destruction of the spermatozoa in the genital passages of the female before they reach the spermathecae, where, under normal conditions, they live for a long time.

It is known that *Syntomosphyrum glossinae* Wtrst, parasitizes the pupae of various species of *Glossina*, and especially those of *G. palpalis*. Two or three of the pupae received from Uganda harboured the parasite, and its development was followed experimentally in the pupae of *Musca domestica*. *W. Y.*

Buxton (P. A.). **Studies on Soils in Relation to the Biology of** *Glossina submorsitans* **and** *tachinoides* **in the North of Nigeria. With an Appendix by** K. Mellanby.—*Bull. Entom. Res.* 1936. July. Vol. 27. Pt. 2. pp. 281–287. With 1 fig.

The author points out that there are many facts indicating the importance of soil in the life of *Glossina*. During his work in the north of Nigeria in 1933, he found reason for believing that the humidity of the atmosphere in the soil may act as a limiting factor upon the puparia of *G. tachinoides* and *G. submorsitans*. It was found that of pupae exposed *in vitro* at a continuous low humidity only a small proportion hatched. It was also shown that many of the puparia exposed to the lower humidities died within a few days; the rest lived through the normal period, but the resulting flies were unable to rupture the puparial skin and died within it. These unfavourable effects of low humidity were unexpected because the country surrounding the laboratory was extremely hot and dry, and flies of the two species were common and there was no evidence of high mortality among puparia in nature.

From observations of this sort Buxton concluded that the relation of puparia to soil should receive much more attention than it has in the past. The experiments described in this paper show that the soil

of the thickets (unlike the more sandy soil of the open country) will take up large quantities of water ; as its colloidal content is high this soil must also possess a great power of retaining the water. Furthermore, even when the soil seems quite dry (water content 4 per cent.) the atmosphere in the soil spaces is very nearly saturated. Although it is not proved, Buxton thinks it likely that the soil atmosphere in the north of Nigeria, even under extreme conditions of heat and drought, may not be so dry as to be unfavourable to the puparia of *Glossina submorsitans* and *G. tachinoides*. *W. Y.*

Nash (T. A. M.). **The Relationship between the Maximum Temperature and the Seasonal Longevity of** *Glossina submorsitans*, **Newst., and** *G. tachinoides*, **Westw., in Northern Nigeria.**—*Bull. Entom. Res.* 1936. July. Vol. 27. Pt. 2. pp. 273–279. With 2 figs.

The two experiments described in this paper were designed to elucidate the seasonal fluctuations in longevity for *G. submorsitans* and *G. tachinoides*.

The following summary is given :—

" 1. There is considerable seasonal variation in the longevity of *G. submorsitans* and *G. tachinoides*, and these variations are negatively correlated with the fluctuations in the maximum temperature curve, *i.e.*, as the temperature rises longevity decreases, as the temperature falls so longevity increases.

" 2. The cycle is as follows : The rains commence and temperature falls, longevity increases and remains high throughout the rains. The wet season ends, temperature rises and longevity decreases. The cold spell intervenes and longevity becomes maximal. The cold weather ends, the temperature soars up and longevity becomes minimal, remaining low until the new rains commence.

" 3. Maximum temperature is considered to be the dominant factor ; favourable humidity cannot increase longevity unless the maximum temperature is favourable.

" 4. The oldest individuals occur in the rains, but the average longevity is highest in the cold season, when both temperature and humidity are favourable.

" 5. In both species females tend to live longer than males.

" 6. In the field *G. tachinoides* males appear to live rather longer than the males of *G. submorsitans*.

" 7. It is doubtful whether wild flies of either species live much more than 2½ to 3 months under the most favourable conditions ; it is probable that in the hottest weather longevity is curtailed to a month or less, and that the production of puparia is seriously affected when the rains are late and the hot weather is prolonged." *W. Y.*

Nash (T. A. M.). **The Part Played by Microclimates in enabling** *Glossina submorsitans* **and** *G. tachinoides* **to withstand the High Temperatures of a West African Dry Season.**—*Bull. Entom. Res.* 1936. July. Vol. 27. Pt. 2. pp. 339–345. With 2 plates.

In a recent paper a description was given of experiments upon the effect of high maximum temperatures upon the longevity of *G. submorsitans* and *G. tachinoides* [this *Bulletin*, 1935, Vol. 32, p. 723]. The present paper carries the investigation further, and the author gives the following summary of the results :—

" 1. It has been confirmed that the lower limit of the critical zone, for fly of medium age, is 102°F. for both species ; this limit is probably even lower for very old *G. tachinoides*.

" 2. The adverse effect upon the fly community of a day when the maximum temperature enters the critical zone is continued among the older individuals for several days following, even though the maximum temperature on these days remains below the lower limit.

" 3. From the mean maximum temperatures recorded over 52 days in 9 microclimates, it would appear that sites on the ground are cooler than those above the surface ; the difference is not very great, the mean for the four ground sites being only 4·4°F. lower than the mean for the five above-ground sites.

" 4. The evidence suggests that on very hot days only the ground within the true forest is safe for tsetse ; in all other sites—above the ground in the true forest or on the ground in the intrusive and peripheral thickets—the temperature is liable to enter the critical zone, and may even reach the upper fatal limit.

" 5. The tsetse community is living very close to the critical zone in the late dry season. Even the coolest ground site yielded an absolute maximum that was only 3·5°F. below the lower limit.

" 6. Site no. 9 gives an indication of how severe the conditions might become in the true forest were the windbreaks of peripheral and intrusive thicket removed.

" 7. In ground sites a shower of rain produces about twice as great an initial drop in temperature, and temperature remains abnormally low for about twice as long, as it does for sites above the surface of the soil.

" 8. The duration of the period of dangerously high temperatures to which the fly community is subjected in the late dry season may be very varied ; it depends upon the incidence of rain in April and May." *W. Y.*

MOGGRIDGE (J. Y.). **Experiments on the Crossing of Open Spaces by *Glossina swynnertoni*.—*Bull. Entom. Res.* 1936. Sept. Vol. 27. Pt. 3. pp. 435–448. With 4 figs.**

The experiments described in this paper were undertaken in order to ascertain the extent to which *G. swynnertoni* is capable of crossing an open space from fly-infested bush when carried (1) by game, (2) by cattle and man, and (3) by man alone.

The author later passes to an investigation of the maximum time that this tsetse fly could be carried on man and on cattle across an open space, and to obtaining information regarding the distance at which a target moving in the open will attract tsetse to it from the bush.

The following is a summary of the conclusions reached :—

" (1) A party of five men and three oxen walking through long grass and under dry season conditions failed to attract fly (*G. swynnertoni*) to them from fly bush at a distance greater than 100 yards.

" (2) The average number of flies attracted out to the party when passing at a distance of 100 yards from the edge of the fly bush for an average time on each occasion of 17 minutes was approximately eight flies.

" (3) Of the total of 61 flies captured on the 100 yards transect 59 flies were captured off the cattle.

" (4) A marked fly preference was shown for two of the oxen ; only 3·39 per cent. of the flies taken off the oxen were captured from the third ox.

" (5) In a similar set of five experiments made later in the dry season over ground which had been partly burnt, giving conditions of excellent visibility, a party composed of four men and three oxen failed to attract more than a few flies from the bush edge. Out of a total of 17 flies captured one was taken at 300 yards, four at 200 yards, and twelve at 100 yards. The average time taken to complete the 100 yards patrol in this set of experiments was 14 minutes.

" (6) The flies were shown on two occasions to be in considerable density on the edge of the bush adjacent to the transects." *W. Y.*

MOGGRIDGE (J. Y.). **Some Observations on the Seasonal Spread of *Glossina pallidipes* in Italian Somaliland with Notes on *G. brevipalpis* and *G. austeni*.**—*Bull. Entom. Res.* 1936. Sept. Vol. 27. Pt. 3. pp. 449–466. With 18 figs. on 3 plates & 1 text fig. (map).

Glossina palpalis has long been known to exist in the great tsetse belts of Central Tanganyika, but, owing to its relative scarcity, it has not attracted the same attention and study which has been devoted to *G. morsitans* and *G. swynnertoni*. As it is probable that any large reclamation measures directed towards the elimination of the latter flies will have to contend also with the population of *G. pallidipes*, the author decided to undertake an investigation on the ecology of that fly. As a preliminary to work on this subject in Tanganyika, he spent a month in investigating the ecology of *G. pallidipes* in Italian Somaliland.

The following summary is given :—

" The only species of tsetse to be found on the Uebi Scebeli is *Glossina pallidipes*, which concentrates in confined areas during the dry season. The fly increases in numbers in the wet season and spreads over the surrounding country to a maximum depth of 6 miles (10 kilometres).

" 2. The presence of deciduous thicket seems an essential constituent of the vegetation forming the true habitat and breeding-place of *G. pallidipes*, and high humidity and shade are essential in the areas over which the fly spreads in the wet season, it being capable of spreading through inhabited and cultivated areas during the wet season.

" 3. *G. pallidipes* is not able to maintain itself permanently under conditions of comparatively low temperature and high humidity in vegetation, of which the dominants are *Acacia arabica* and *A. Benthamii*, in the absence of deciduous thicket types.

" 4. Breeding is confined to areas of deciduous thicket, preference being shown for horizontal growing trees and for logs rather than for the bases of thicket types.

" 5. *G. pallidipes* is capable of being carried considerable distances by natives bearing loads.

" 6. *G. pallidipes*, *G. brevipalpis* and *G. austeni* are found on the River Juba.

" 7. In the Juba area *G. pallidipes* flourishes in deciduous thickets, while *G. brevipalpis* is found in great density in the rain forests, in which *G. austeni* is also encountered.

" 8. A fungus pathogenic to tsetse is present in the Alessandra fly area."

W. Y.

BURTT (Eric). **A Simple and Rapid Method for Extraction of the Salivary Ducts of Tsetse-Fly, suitable for Trypanosomiasis Examinations.**—*Ann. Trop. Med. & Parasit.* 1936. July 17. Vol. 30. No. 2. p. 265.

A simple modification of Lloyd and Johnson's method is described, which the author claims to have the advantage, not only in the possibility of a higher percentage of duct extraction, but also that any necessity of observing or handling the fine threads of the ducts themselves during the operation is obviated. The method is as follows :—

" The chloroformed fly is held in the hand, and the legs are snipped off with the scissors. A fine pin is then inserted through the pleuron of the thorax at an angle of roughly 45°. By means of this pin the fly is fixed

and completely immersed, ventral side uppermost, in normal saline contained in a small dissecting-dish, having a layer of paraffin wax at the base, and of dimensions suitable for placing on the microscope stage. A second pin is similarly inserted through the pleuron of the other side of the thorax, so that the fly is firmly held in position on the wax. The abdomen of the fly is now snipped off, in the saline, with fine scissors.

" A slide having been placed in readiness, with a drop of saline on it, the fly is then examined under the dissecting microscope. If the palps still adhere to the proboscis, it is as well to separate them from it with a needle. The proboscis is then gripped with fine forceps along its length, right down to the bulb expansion at its base, and a gentle and steady pull is given until it is removed. Whilst the pull is being exerted, the object is observed under the microscope, and great care is taken that the attachments of the proboscis give way gently and steadily, and not with a sudden jerk, the force exerted with the forceps being regulated accordingly.

" The proboscis is then completely removed and mounted on the slide, and the salivary ducts will be found still attached to it and ready for examination." *W. Y.*

Corson (J. F.). **A Second Note on a High Rate of Infection of the Salivary Glands of *Glossina morsitans* after feeding on a Reedbuck infected with *Trypanosoma rhodesiense*.—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. July 31. Vol. 30. No. 2. pp. 207–212.

In a recent paper [this *Bulletin*, 1935, Vol. 32, p. 709] the author recorded experiments in which the rates of infection of the salivary glands of *G. morsitans*, which had fed on a reedbuck, infected with *T. rhodesiense*, were 60 and 33·3 per cent., respectively ; the rate in a control experiment with a monkey was only 1·1 per cent. In a further control experiment sheep were infected by flies from the reedbuck, but flies fed on these sheep developed but few (2·7 per cent. or less) salivary gland infections.

The reedbuck used in these experiments was darker and greyer than the kind usually seen in the Tinde district and is known locally by the name of " mongee," whereas the usual variety is called " njaa." In December, 1934, not long after the " mongee " experiment, flies were fed on an infected njaa, but here only 6 per cent. of salivary gland infections were obtained.

On December 24th, 1935, another young specimen of " mongee " was brought to the laboratory, and it was decided to infect the animal with *T. rhodesiense* and then to feed *G. morsitans* upon it to see if a high rate of salivary gland infections would be again obtained. Details of the experiment are given. Three batches of flies were used : the 60 survivors of the first lot were killed and dissected 28 days after the first infecting feed and 26 (43·3 per cent.) of gland infections were found ; the second lot killed 24 days after the first infecting feed showed that 16 (64 per cent.) of the 25 survivors had gland infections, and the third lot killed at the same time, consisting of 6 flies, showed one gland infection. Altogether, therefore, 43 of the 91 flies, or 47 per cent., had infected salivary glands. This is in striking comparison with the results obtained with other animals infected with the same strain of *T. rhodesiense*, details of which are given in a table.

The paper closes with the following summary :—

" Another instance of a high rate of infection of the salivary glands of *G. morsitans*, after feeding on an infected reedbuck, is recorded ; and it is suggested that the species of animal may be a determining factor in the rate of infection of the flies. Some other figures are given for comparison.

Robertson's views on an endogenous cycle of *T. gambiense* in monkeys are referred to and the opinion is expressed that they are not applicable to infections with *T. rhodesiense*. It is suggested that surveys of animals in sleeping sickness areas are needed and also further experiments with single animals and with groups of animals." *W. Y.*

CARPENTER (G. D. H.). **Observations by Mr. T. W. Chorley, F.R.E.S., on Dragonflies attacking the Tsetse Fly, *Glossina palpalis* R. D.**—*Proc. Roy. Entom. Soc. London.* 1935. Vol. 10. pp. 78–79. [Summarized in *Vet. Bull.* 1936. Sept. Vol. 6. No. 9. p. 717.]

"CHORLEY reports that while visiting Kome Island on Lake Victoria he observed dragon-flies attacking *G. palpalis* in clearings on the foreshore. The dragon-flies followed natives and darted swiftly on any tsetse flies that alighted to feed, immediately devouring the engorged entrails. No other flies were attacked. Tsetse flies were not followed into the forest, where they were abundant. In the clearings where they were attacked they were scarce."

CORSON (J. F.). **The Influence of Repeated Transmissions in Animals on the Virulence of *Trypanosoma rhodesiense* and *Trypanosoma brucei*.**—*Ann. Trop. Med. & Parasit.* 1936. July 17. Vol. 30. No. 2. pp. 211–220. [10 refs.]

Corson discusses the influence on polymorphic trypanosomes of maintenance by direct passages, as used in laboratories where tsetse cannot be obtained; he reaches the conclusion that little is known about the subject.

With the object of throwing some light on the matter he considered it useful to examine records of transmissions of some freshly isolated strains of *T. rhodesiense* and *T. brucei*. As polymorphism and the production of posterior-nuclear forms were not lost in any of the strains personally studied (*i.e.* all but two) attention was limited to virulence, and the duration of life after infection was taken as a rough measure of virulence for a species of animal.

In the case of one strain (*T. rhodesiense*, Kibondo), transmissions were made by single isolated *G. morsitans*, except the first passage, and rats were infected from time to time by these single flies, so that the date of their infection was known. Three of the strains were transmitted through goats and sheep, while occasional passages through guineapigs, birds and hyrax appear in the records.

When transmissions were made through rats only, there was an increase in virulence in most strains, but this was not evident in sheep and goats. In the strain, *T. rhodesiense*, Kibondo, there was no clear indication of any stabilizing action of repeated fly-passages, as judged by the infection in test rats. The records are set out in a series of tables, which must be studied in the original by those interested.

W. Y.

POINDEXTER (Hildrus A.). With the Technical Assistance of Robin I. BENNETT. **Some Observations on the Nature of the Thermo-precipitation Reaction in *Trypanosoma equiperdum* Infection.**—*Amer. Jl. Trop. Med.* 1936. July. Vol. 16. No. 4. pp.485–492.

In a previous paper the author has shown that extracts of the spleen of rats, guineapigs and rabbits infected with *T. equiperdum* contain a

thermoprecipitinogenic substance [this *Bulletin*, 1935, Vol. 32, p. 362]. In his previous work three questions remained unanswered: (*a*) What is the nature of the thermostable substance and the nature of the reaction? (*b*) What tissue or organ extracts of the body give the better results and why? (*c*) What laboratory animal produced the best extracts, and what animal showed the highest titre of immune serum? The present article reports the results of experiments in which an attempt is being made to answer these questions. The following are the summary and conclusions :—

" The nature of the thermostable extracts from the tissues of *T. equiperdum* infected animals appears at least to be a co-mingled protein, even though a large portion of it may be carbohydrate.

" The extracts of the tissues of the organs that are more active in hemotopoiesis and hemoclasis contain the greatest amount of the thermoprecipitinogenic substance.

" The extracts of the spleen and lymph node of young offspring of infected guinea pigs' mothers give a positive reaction while the bone and marrow and heart muscle extracts give negative results.

" The titer of immune sera from infected rabbits was higher than from other infected laboratory animals tested. This varied, however, with the virulence of the strain of the organism and the degree of spleen response as shown by development." *W. Y.*

JONES (E. R.). **The Use of Nitric Acid in the Serological Diagnosis of Cattle Trypanosomiasis.**—*Vet. Record.* 1936. May 9. Vol. 16. No. 19. pp. 602–605.

A large number of tests were carried out with 20 different chemical agents, all based on the theory of precipitation of serum euglobulin excess in trypanosomiasis, either by distilled water or by solutions of various chemicals. The preliminary investigation showed that all the substances tested, except nitric acid, were non-specific. Thereafter only two tests were employed, *viz.* D.O.P.A. (dioxyphenylalanine) and nitric acid, and finally nitric acid alone. In the earlier tests 1 drop of clear serum was added to 1 cc. of the reagent, but later work showed that the optimum ratio of serum to reagent was 1 to 25. Details of the observations are given in tables. The general conclusion is that the nitric acid test is specific for trypanosomiasis, but is only obtained in 45 to 50 per cent. of cases. The reaction is seldom given in the early stages of the infection when trypanosomes are present in the blood, and chiefly occurs in chronic or " latent " infections. *W. Y.*

DE GIORGI (Mario). La reazione di Foulton o " metodo al cloruro mercurico " nei ratti infestati da tripanosoma. [**Foulton's Mercuric Chloride Test for Trypanosome Infection.**]—*Arch. Ital. Sci. Med. Colon. e Parassit.* 1936. July. Vol. 17. No. 7. pp. 396–407.

The author carried out the test with dilutions of the mercuric chloride ranging from 1 : 1,000 to 1 : 80,000, using the serum of animals (rats) infected with *T. evansi*, *T. brucei*, *T. pecaudi*, and a species from the camel. One drop of the serum was brought into contact with 0·5 cc. of the reagent, vigorously shaken for some minutes and left at room temperature. Controls were put up with serum and physiological saline. Results were noted after 45 minutes and after 24 hours. The

findings are given in detailed protocols, but need not be recorded, for the author concludes that " the reaction is of no practical use in the diagnosis of trypanosome infection of white rats." *H. H. S.*

Gold Coast: Report on the Department of Animal Health for the Year 1935–36 [Stewart (J. L.), Director of Veterinary Services]. [**Trypanosomiasis** pp. 13–17.]

In last year's report details are given of 65 cattle infected with trypanosomes treated with Surfen C [this *Bulletin*, 1936, Vol. 33, p. 663]. Most of these cattle have now been disposed of, and only 7 are still at Pong-Tamale; none of these have relapsed. Of those which have been disposed of, 9 have either relapsed or acquired a new infection. Experiments have shown that Surfen C is more effective when given intravenously than when administered intramuscularly, but, unfortunately, when given by the former method alarming symptoms are sometimes produced.

Several outbreaks amongst native cattle were treated by means of routine tartar emetic or antimosan inoculations.

The bulk of this paper is occupied with descriptions of various measures devised with the object of eradicating tsetse-fly at Pong-Tamale and the surrounding areas. *W. Y.*

Robinson (Saul S.). **Dermatitis due to Tryparsamide. Report of a Case.**—*Arch. Dermat. & Syph.* 1936. Aug. Vol. 34. No. 2. pp. 251–252.

Between May 31 and December 12, 1935, the patient, a woman aged 34, received 18 injections of tryparsamide, the last 13 of which each consisted of 2 gm. On December 13, the patient complained of a red itching eruption appearing about 8 hours after each of the 3 previous injections. A description of the eruption is given. The author points out that although dermatitis due to tryparsamide is considered mild, exfoliative dermatitis due to its use has been recorded by various authors. The increased intensity of the dermatitis in the present case, after each administration of the drug, necessitated its cessation in order to prevent a possible exfoliative dermatitis. *W. Y.*

Fourche (J. A.) & Morlighem (H.). Traitement de la trypanosomiase par le tryponarsyl et le 309 Fourneau en mélange. [**Treatment of Trypanosomiasis by a Mixture of Tryponarsyl and 309 Fourneau.**] —*Ann. Soc. Belge de Méd. Trop.* 1936. Sept. 30. Vol. 16. No. 3. pp. 317–332.

The authors record the result of treating 42 cases of trypanosomiasis, mainly in a very advanced stage, by the method recommended recently by de Marqueissac, *i.e.*, by the simultaneous administration of moranyl and tryparsamide. They prepared a 10 per cent. solution of moranyl and a 20 per cent. solution of tryponarsyl. Both solutions were taken up in the same syringe and injected in mixture. The dose of moranyl used was 2 cc. (20 cgm.) and that of tryponarsyl 5 to 8 cc. (1 gm. to 1·6 gm.); in young children the doses were reduced. It was their intention to give 11 or 12 injections at 4-day intervals, but the supply of moranyl was insufficient, and the treatment had to be concluded by tryponarsyl alone or in combination with Dn. 18. The patients were

re-examined a year after the commencement of the course of treatment.

Details are given of 42 cases, of which no less than 40 were re-examined. In all cases gland puncture remained negative when it was negative to begin with, and became negative when it was positive at the beginning. Almost all the cases had at first pronounced changes in the spinal fluid. Of the 37 in whom the spinal fluid was re-examined, 36 showed a marked fall in lymphocytes, and in 31 of these the number of leucocytes was between 1 and 10.

The general condition had improved greatly in all cases ; the weight has increased and the oedemas have disappeared. It is remarked that the clinical improvement was apparent after 4 or 5 injections. The nervous troubles have disappeared in all but 2 cases ; and there were no accidents, except in one very old man who developed transient visual disturbance. *W. Y.*

Zschucke (Johannes). Untersuchungen ueber eine Heilwirkung des " B 205 " auf die Schlafkrankheit des Menschen bei peroraler Verabreichung. [**Investigation on the Curative Action of " Bayer 205 " on Human Sleeping Sickness after Oral Administration.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1936. Oct. Vol. 40. No. 10. pp. 449–455. With 6 figs. [10 refs.]

The author has tested the value of Bayer 205 given by the mouth on a number of cases of human trypanosomiasis in Fernando Po and the adjoining mainland. The doses given were : 1st day 3 gm., 2nd day 4 gm., 3rd day 5 gm., and 5th and 6th days 6 gm. The blood of 3 of the 6 patients became free of parasites 48 hours after the first dose, and 5 of the patients relapsed. The swelling of the lymphatic glands was not influenced, but the tremors, muscular pains and general symptoms quickly disappeared. The general conclusion reached is that this method of administering Bayer 205 results in only exceptional cures, but produces a temporary improvement. This is due to the fact that different individuals absorb the drug in different degrees.

W. Y.

i. Sudan : Annual Report of the Veterinary Service, 1935 [Williams (H. B.), Director]. Appendix I. pp. 30–32.—**I. Camel Trypanosomiasis. II. Equine Trypanosomiasis caused by** *Tryp. congolense* [Bennett (S. C. J.), Vet. Res. Officer].

ii. Bennett (S. C. J.). **The Treatment of Equine** *Trypanosoma congolense* **Infections with Surfen C (Bayer).**—*Jl. Comp. Path. & Therap.* 1936. June. Vol. 49. Pt. 2. pp. 151–159.

i. A single intravenous dose of 4 gm. of Naganol effects a primary cure in the vast majority of camels. A period of " immunity " which, the author states, is " actually protection by residual Naganol " follows treatment, and this period is proportional to the dose of Naganol given. [The immunity is probably in part at least due to the immune body formation which occurs when a trypanosomal infection is cured by any drug.] The refractory period varies considerably in individual camels, some animals have been shown to be immune for nearly 4 months, whilst others were susceptible in less than 2 months. The relapse rate after 4 gm. of Naganol is exceedingly small.

ii. An account is given of the trial of Surfen C (Bayer) in the treatment of 14 horses infected with *T. congolense.* The author summarizes his observations as follows :—

" (1) It is almost certainly unsafe to administer Surfen C to horses intravenously.

" (2) While 'safe' in the usual chemotherapeutic sense to inject it subcutaneously, large swellings developing at the site of injection render this route objectionable.

" (3) Intramuscular injection is less objectionable than subcutaneous, although even by this route, in spite of giving multiple small doses, or even of giving a series of doses at intervals of a week or ten days, troublesome local swellings may develop.

" (4) In no case in the recorded series of treatment did any toxic symptoms develop following intramuscular injection, indicating that horses can, apart from possible surgical complications, probably tolerate appreciably larger doses than were used in this series of observations.

" (5) Surfen C is certainly capable of curing nearly all, if not all, cases of *T. congolense* in horses, and in this respect it is the best agent hitherto studied. Its only drawback—and it is a serious one when the necessity for routine mass treatment has to be contemplated—seems to be referable not so much to the drug as to the patient, namely, the extreme variability of individual response. Some horses are cured by a single dose of 1 gm./100 kg. while others require much more. It is therefore unlikely that any orthodox course of treatment will be developed ; each patient will call for close individual attention, even to the degree of confirming cure by small-animal sub-inoculation." W. Y.

Evans (J. T. R.). *Trypanosoma congolense* **Infection in Cattle: Treatment by Antimosan and Surfen " C."**—*Jl. Comp. Path. & Therap.* 1936. June. Vol. 49. Pt. 2. pp. 160–162.

In 1934, twenty-seven bulls infected with *T. congolense* were treated with antimosan ; 20 received 5 injections at weekly intervals and the remainder 3 injections. The dose was 10 cc. per 100 lb. of body weight. The following year 12 infected bulls were treated by a course of 5 weekly injections. The general conclusion reached is that a full course of the drug " offers great hope of a complete cure being effected." Experiments with " Surfen C " indicated that the results obtained with a single dose were equal to those obtained from a full course of antimosan. This is, of course, a matter of great importance in field work.

W. Y.

Roskin (Gr.) & Schischljajewa (S.). Salvarsantherapie und Ultravioletstrahlen. [**Salvarsan Therapy and Ultraviolet Radiation.**]—*Zent. f. Bakt.* I. Abt. Orig. 1936. June 12. Vol. 136. No. 7/8. pp. 425–429. [13 refs.]

In 1929, Roskin and Romanowa showed that the therapeutic action of salvarsan was considerably increased by the subsequent radiation of the treated animal [this *Bulletin*, 1930, Vol. 27, p. 233 and p. 837]. In order to obtain this result it is essential that the drug be given before the radiation ; but the result is also obtained if the treated animal is injected with the serum of a healthy irradiated mouse. Radiation alone has no effect on the infection. Study of the serum of irradiated animals revealed the presence of Factor A. The mechanism of production of this Factor is bound up with the integrity of the reticulo-endothelial system, and it is not formed in blockaded animals.

Later work showed that irradiation similarly enhanced the action of old salvarsan on *Sp. duttoni* infection of the mouse, and that of neosalvarsan on *Sp. pallida* infections. In the present work it was decided to ascertain whether ultraviolet radiation increased the action of other drugs. Experiments with germanin and tartar emetic gave negative results. The view that the results obtained with novarsolan would apply to all arsenical preparations proved to be wrong, because negative results were obtained with all the pentavalent and trivalent compounds of arsenic examined.

The authors next pass to a consideration of the fact that GIEMSA and ELLENBERGER (1930) and GIEMSA and JEROVEC (1931) had been unable to confirm their results. The only difference between their experiments and those of the German investigators was that whilst they had used the Russian preparation novarsolan, the Germans had used German neosalvarsan. Repeating their experiments, Roskin and his colleagues obtained 100 per cent. of positive results with novarsolan, but with neosalvarsan the results were negative. Further work with 8 preparations of neosalvarsan and 4 of old salvarsan showed that only novarsolan gave positive results.

Roskin next inquires whether the mechanism of the action of ultraviolet radiation in increasing the therapeutic effect of German old salvarsan on *Sp. duttoni* infections is similar to that of novarsolan on *T. equiperdum*. With that object in view he performed a long series of experiments on the treatment of *Sp. duttoni* infections in mice with old salvarsan. All the mice received the same (non-curative) dose of old salvarsan. Half of them were injected subcutaneously with 0·3–0·4 cc. of the serum of irradiated healthy mice. Of the 54 given the combined treatment 75 per cent. were cured, but of the 56 which were given the drug alone only 5·8 per cent. were cured. The authors conclude from this that the mechanism of action of old salvarsan on *Sp. duttoni* infection is the same as that of the Russian novarsolan on *T. equiperdum*.

W. Y.

RUSSELL (Helen). **Observations on Immunity in Relapsing Fever and Trypanosomiasis.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. July 31. Vol. 30. No. 2. pp. 179–190. With 6 charts. [15 refs.]

This paper is concerned with some aspects of immunity in relapsing fever and trypanosomiasis.

From the serological point of view the interest in the two infections is that in both there is evidence that the infecting parasite is able to readapt itself—or to vary serologically—several times in the body of a host without any loss of pathogenicity in the variants. A short summary of the work which has been done on the serology of relapsing fever and trypanosomiasis is given.

JANCSÓ (1918) observed that the spirochaetes of an attack of relapsing fever differed serologically from those of the relapses; and CUNNINGHAM (1925) showed that at each relapse in any one animal the spirochaete is of a new serological type: he also demonstrated the alternation of types which occurs when the infection is passed on at a relapse into a new animal. The author (1931) in the Gold Coast confirmed Cunningham's results. It was concluded that *T. recurrentis* had the capacity of producing several serological variants in one host, each variant being equally pathogenic. The limited number of variants which is detected in any epidemic was explained by the

alternation of variants which occurs when the parasite reaches a new host which is not already immune to any variant; this alternation tends to keep certain variants dominant.

In a chart details are given of the ordinary course of relapsing fever in a series of *Cricetomys gambianus*, in which rat the disease is very similar to human infection. It shows the emergence of a new serological variant at each relapse and the appearance of a specific lesion for each variant in turn. If the blood is passed to a new animal in the interval between the attacks, and an infection occurs in the new animal, the type of spirochaete is serologically identical with that which appears in the next relapse of the donor. Another chart shows the average titre of the lysin for the attack and first relapse spirochaetes in a series of *C. gambianus*; and still another chart demonstrates the alternation of variants which occurs when relapses are passed on to new animals.

The special interest in relapsing fever is in the ability of the spirochaete to readapt itself antigenically several times in one host without loss of pathogenicity. The possible variants in one host are limited because the infection does die out. This may be explained either by the host producing an antibody antagonistic to all variants (but there is, as yet, no evidence of this), or it is possible that a strain of spirochaetes cannot readapt itself more than a few times in one host.

The author's immunological studies on trypanosomal infections were made at Liverpool in 1934. Rabbits were infected with *T. rhodesiense* and at weekly intervals mice were injected with blood from the rabbits; at the same time each week serum was stored in the ice-chest in order that it could be tested for lysins as soon as the mouse infections were positive. It was found that the rabbit serum removed each week contained lysins of low titre for the variant trypanosome, which had been isolated the week before, but had no lytic effect on the variant which was present when it was withdrawn. The technique used to detect lysins was that described by the reviewer and his colleagues in their work on chemotherapy. The results of these experiments are given in tables. Russell concludes that the course of an infection with a pathogenic trypanosome depends on the capacity of the parasite to vary serologically so often in the body of the host that it defeats the possible variations of the host's defence. *W. Y.*

Bevan (Ll. E. W.). **Notes on Immunity in Trypanosomiasis.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. July 31. Vol. 30. No. 2. pp. 199–206. [10 refs.]

In 1928, the author introduced a method of inoculation against trypanosomes whereby cattle were deliberately infected with known strains of typanosomes, and were then treated with a view to setting up a state of tolerance. It was found that the treated animals could return to the fly area and remain healthy in spite of re-infection. Breakdown of tolerance occurred, however, from various causes. The cattle became infected with trypanosomes against which they had not been rendered tolerant; and such factors as starvation, overwork, mineral and vitamin deficiencies and intercurrent infections also cause breakdown of resistance.

It therefore became obvious that an alternative process, based upon a firm "sterile immunity" rather than an immunity tolerance, was desirable, and it was decided to endeavour to devise such a method.

References from the literature are quoted to show the relative resistance of young animals to the ravages of trypanosomiasis. The author describes a number of experiments with rats and mice and a virulent strain of *T. rhodesiense*. The following summary is given :—

" 1. The treatment of cattle suffering from trypanosomiasis with intravenous injections of potassium antimonyl tartrate was introduced into Southern Rhodesia in 1909 and has since been adopted with considerable success.

" 2. In the course of 25 years' experience, it has frequently been observed that treated recovered animals may return to the tsetse-infested areas and remain there apparently in good health in spite of re-infection. This observation has been confirmed by veterinarians in other parts of Africa.

" 3. Treated animals either are sterilised of the parasite and again become susceptible to re-infection, or are not completely sterilised and become tolerant.

" 4. A method of inoculation and treatment based upon these observations was introduced in 1928. It consisted of the deliberate infection of cattle with known strains of trypanosomes—preferably the strains of the district in which the animals were to be exposed—and of treating them at the appropriate time.

" 5. In this manner they were rendered tolerant or immune, but in practice it was found that their tolerance broke down when the animals were subjected to adverse conditions. To obviate breakdown would involve a revolution of present-day conditions of animal husbandry in tsetse-infested areas.

" 6. Tolerant animals become reservoirs of infection ; therefore a complete sterile immunity, rather than a tolerance, would be preferable.

" 7. In nature the resistance of the wild animals in tsetse-infested areas is, in most cases, a tolerance. A similar condition is sometimes met with in indigenous domestic animals.

" 8. Old hunters and explorers have attributed this resistance to the infection of young animals during their early days.

" 9. Recent experiments with rats and mice indicate that young animals are susceptible to infection ; but if well nourished and not unduly disturbed, they may survive an infection sufficiently virulent to kill weaklings or adults. If they recover, they again become susceptible ; but if re-infected during the course of the original infection, they become tolerant.

" 10. These observations indicate how tolerance may be acquired in nature and suggest that it is maintained by repeated re-infection.

" 11. They explain the peculiar incidence of latent cases of sleeping sickness in Southern Rhodesia and suggest preventive measures.

" 12. They also indicate that the tolerance of inoculated cattle should be maintained by repeated syringe or fly infection.

" 13. The integral properties of the young which render it partly resistant have not been determined, but appear to be worthy of further research.

" 14. A method of setting up a complete and lasting sterile immunity in man and animals against trypanosomiasis comparable to that commonly set up against bacterial and virus diseases appears to offer a solution to the tsetse fly problem." *W. Y.*

BROWNING (C. H.) & GULBRANSEN (R.). **Immunity following Cure of Experimental *Trypanosoma brucei* Infection by a Chemotherapeutic Agent.**—*Jl. Path. & Bact.* 1936. Nov. Vol. 43. No. 3. pp. 479–486. [19 refs.]

In this work the authors have studied the immunity which an experimental animal infected with trypanosomes exhibits after cure by a

single dose of a drug. They show that it depends on (*a*) the particular strain of parasite, and (*b*) the species of the host, irrespective of the clinical type which the disease assumes in the latter.

In the case of mice infected with highly virulent strains of *T. brucei*, it has usually been found that when cure is effected by a single dose of a drug like arsacetin immunity reaches its height within 10 days. Under these conditions the immunity was usually manifested by a few days protraction of the incubation period. In the present work this was confirmed for 3 strains of *T. brucei*, *viz.*, Paris II and III and Wormall. In the case of the Prowazek strain immunity to reinoculation with the homologous organism is so pronounced that frequently infection fails to develop, a considerable proportion of cured animals reinoculated after an interval of 23 days failing to become infected.

Hartmann (1930) found that in rabbits cured of infection with the Prowazek strain complete immunity might persist for 22 to 33 weeks. In the authors' experiments with rabbits the three strains of *T. brucei* mentioned above were used. Of 9 rabbits inoculated with these strains—none of which produces a high degree of immunity in mice—and cured by a single dose of a rapidly excreted drug (styryl 314) all except one resisted reinoculation from 6 to 32 months later. Three of them resisted 3 reinoculations from 12 months onwards.

The serum of these immune rabbits exerted some protective action, which was shown when it was added to living trypanosomes of the homologous strain and the mixture injected into mice. *W. Y.*

Lourie (E. M.) & O'Connor (R. J.). **Trypanolysis *in vitro* by Mouse Immune Serum.**—*Ann. Trop. Med. & Parasit.* 1936. Oct. 21. Vol. 30. No. 3. pp. 365–388. [24 refs.]

The authors have studied by *in vitro* technique the trypanolytic substance which develops in the blood of infected mice after treatment with halarsol. They have had no difficulty in obtaining lysis of the homologous strain, by the serum of mice immune (or relatively immune) to various trypanosomes, *viz.*, *T. rhodesiense*, *T. equinum*, *T. equiperdum* and two strains of *T. brucei*, all of which had been preserved in mice for considerable periods. Whilst lysis was rapid in presence of complement, it also occurred, but more slowly, in its absence. The authors spent some time examining the rôle of complement in the phenomenon, and also in investigating the influence of various factors upon the trypanolytic titre of the immune serum. They summarize their results as follows :—

" 1. It is well known that, following suitable drug treatment of mice infected with one of the rapidly fatal strains of trypanosome, there is an immunity, or relative immunity, to reinfection with the same strain. Since the work of Ehrlich and Shiga (1904) it has been repeatedly reaffirmed by a considerable number of workers, to some of whom we have referred in the text, that this immunity is of a very transient nature, generally being lost in the course of a few weeks. However, in our experience, immunity to reinfection is generally retained for at least as long as 8 months after treatment.

" 2. Although trypanolysis *in vitro* by immune serum of larger animals has been established for more than 30 years, very scant attention has hitherto been paid to the demonstration of this phenomenon by mouse immune serum. Several writers declare that trypanolysis *in vitro* by mouse immune serum does not occur at all, or does so only occasionally and in very slight degree—and this failure has been ascribed to the lack of complement in mouse serum. We have found that trypanolysis by mouse

immune serum may readily be demonstrated *in vitro* at 37°C., not only in the presence of added haemolytic complement, but also in the entire absence of that factor. In the former case the trypanocidal action is complete within half an hour, and the titre is relatively high ; in the latter case the action is much more protracted, and the titre is lower. In some instances, however, in the presence of added complement, trypanolysis is unduly delayed in higher concentrations of mouse immune serum, while being rapidly effective in lower concentrations. We give experimental support for the belief that this anomaly is due to an anti-complementary action of mouse serum.

" 3. Trypanosomes have been sensitized, through contact with mouse immune serum at 0°C. for 1 hour. By washing and then distributing these parasites among tubes containing dilutions of haemolytic complement (fresh guinea-pig serum), it has been found that, under the conditions of our experiment, a concentration of 1 : 16–1 : 32 of complement is sufficient for trypanolysis to take place within half an hour at 37°C. In the absence of complement, however, trypanosomes sensitized in the above manner do not undergo lysis during a period of 24 hours.

" 4. Figures are given showing the influence upon the trypanolytic titre of mouse immune serum (in the presence of complement) of the following factors :—(*a*) time since treatment, (*b*) degree of infection, and (*c*) size of dose. The general trend is for the titre to rise steeply during the first few days, reaching a high level, which may be as much as 1,024, or even 2,048, between about the fourth and eleventh days. There follows a gradual decline during the next 3 or 4 weeks, till a low range of between 2 and 32 is reached, and this is maintained, with a few defections to below 2, for at least as long after treatment as 8 months. The curve is apparently not markedly influenced either by the degree of infection at the time of treatment, or by the dose of drug given, although there is indeed a slight delay in the appearance of trypanolysins in the case of lightly infected mice treated either by a small or a large dose.

" 5. Trypanolysis *in vitro* of the homologous parasites has been observed by sera from mice immune respectively to each of five strains (comprising four separate species) of pathogenic trypanosome. While we have made no cross-tests between any of these sera and the five corresponding strains, a high degree of specificity has been shown between mouse immune serum for our *T. rhodesiense*, on the one hand, and immune serum for a relapse off-shoot of the same strain, on the other. The trypanolytic titres attained, at various times after treatment, by immune sera for each of the strains (including the relapse off-shoot just mentioned) upon which fewer observations have been made, all fit perfectly into the curve of titre for immune serum in respect of the strain of *T. rhodesiense* upon which the greater part of the present work has been done.

" 6. The trypanolytic titre of mouse immune serum, as tested in the presence of complement, is unaffected by heating to 60°C. for half an hour, but is materially reduced by a temperature of 64°C. for half an hour. The serum may be stored at 0°C. for at least 6 weeks, without any loss in its potency." *W. Y.*

SCHILLING (Claus). **Immunization against Trypanosomiasis, 3rd Contribution.**—*Jl. Trop. Med. & Hyg.* 1936. Oct. 1. Vol. 39. No. 19. pp. 221–222.

——. Immunisierung gegen Trypanosomenkrankheiten.—*Deut. Med. Woch.* 1936. Oct. 16. Vol. 62. No. 42. pp. 1715–1716.

——. Immunisation contre les maladies à trypanosomes.—*Bull. Soc. Path. Exot.* 1936. Oct. 14. Vol. 29. No. 8. pp. 886–888.

These papers give an English, German and French version of the same theory. They deal with matter which has already been published elsewhere and noticed in this *Bulletin.* *W. Y.*

Schilling (Claus) with H. Schreck, H. Neumann & H. Kunert. Versuche zur Schutzimpfung gegen Tsetsekrankheit. V. Teil. [**Experiments on Protective Inoculation against Tsetse-Fly Disease.**] —*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Sept. 18. Vol. 89. No. 1/2. pp. 112–114.

Later information is given regarding the fate of calves immunized by the minimal infection method [this *Bulletin*, 1935, Vol. 32, p. 714]. Of 12 calves premunized by 4 minimal injections of 10–50 trypanosomes and then sent into a tsetse area, 9 (66 per cent.) were alive 23 months later. Of 13 control animals 3 (23 per cent.) were alive.

Experiments are described showing that the resistance of mice and dogs to *T. congolense* can be raised by the same method of repeated minimal infection. *W. Y.*

Schilling (Cl.) ; Roubaud (E.). Au sujet des modes divers de l'évolution trypanosomienne chez les glossines. [**The Various Methods of Evolution of Trypanosomes in Glossina.**]—*Bull. Soc. Path. Exot.* 1936. Oct. 14. Vol. 29. No. 8. pp. 817–821.

This very interesting correspondence was provoked by the recent paper of Roubaud on this subject [this *Bulletin*, 1936, Vol. 33, p. 180].

Schilling writes that if the proboscis of a tsetse is examined some hours after a meal, it is found to contain a limpid fluid practically devoid of red cells. This is serum which remains in the labial cavity ; in the intervals between meals this fluid becomes mixed with saliva from the hypopharynx and also by diffusion with the contents of the pharynx and even of the proventriculus. Schilling believes that it is the composition of this serum-saliva mixture which determines the fate of trypanosomes entering the proboscis. Those flagellates which cannot adapt themselves perish ; the more quickly they adapt themselves the more quickly they multiply and change into metacyclic forms.

Trypanosomes of the *vivax* group adapt themselves most easily to the serum-saliva medium ; they develop there, remain in the proboscis, enter the hypopharynx and complete their development. They do not invade the salivary glands, which contain pure saliva, nor do they invade the pharynx.

T. congolense and its allies adapt themselves easily to the serum-saliva medium. The infection may be limited to this medium, but very often they descend into the intestine, where they develop. Schilling entirely agrees with Roubaud that this is a " route fausse " which only leads to an impasse of no importance for the developmental cycle. He asks whether it is necessary to assume an evolution in the pharynx and proventriculus and a migration back towards the proboscis. He believes that it is possible that a minute quantity of saliva entering the proximal part of the intestine favours the evolution of the cyclic forms which then ascend towards the labial cavity.

T. brucei and its allies finish their development in the pure saliva of the glands and hypopharynx. But how do they get there ? The theory that they traverse the body cavity from the gut can be dismissed as highly improbable. Schilling considers it more likely that scanty trypanosomes pass immediately into the hypopharynx and thence into the salivary glands, where they establish themselves and undergo their development. The flagellates of this group are polymorphic, and it is possible that among the forms one may be able to adapt itself to the

saliva more readily than the others ; it rapidly ascends the hypopharynx in order to attain as quickly as possible to the place containing the greatest concentration of saliva, *viz.*, the glands themselves. The other trypanosomes of this group pass into the intestine and evolve there into intestinal flagellates—an evolution which is primitive and aberrant.

Roubaud finds himself in the main to be in agreement with these views. He also considers the intestinal infections observed in the groups *congolense* and *brucei-gambiense* to be, as a rule, without issue. He agrees that Schilling's speculations regarding the method by which the group *brucei-gambiense* reach the salivary glands is plausible, but points out that the proof is still lacking. *W. Y.*

Mesnil (F.), Leger (M.) & Pérard (Ch.). Essais divers d'infection des poules par des trypanosomes pathogènes de mammifères. [**Attempts to infect Fowls with the Pathogenic Trypanosomes of Mammals.**]—*Bull. Soc. Path. Exot.* 1936. June 10. Vol. 29. No. 6. pp. 679–682.

After briefly reviewing the literature relating to this subject, the authors describe various experiments performed by themselves during recent years.

The first series of experiments was conducted in 1928–1929. Six animals were inoculated with 1 cc. of blood heavily infected with *T. gambiense* : 1 cock and 1 hen were inoculated into the caruncle, 2 cocks subcutaneously and 2 cocks intraperitoneally. None of the birds became infected. In a second experiment various fowls were inoculated with *T. gambiense* and some kept at low temperatures and others at high temperatures ; the results were all negative. In a third experiment 2 cocks were inoculated with *T. rhodesiense* without result.

The second series of experiments was undertaken in 1931. In these the authors first tried other trypanosomes, *viz.*, *T. brucei* and a second strain of *T. gambiense*. In later experiments the effect of blocking the reticulo-endothelium by chinese ink and iron sugar was tested. In all these animals the results were again negative.

The third and fourth series of experiments, which were conducted in 1933–1934 and in 1935, respectively, were of a similar nature and gave equally negative results. The authors conclude by observing that it seems to be very difficult to ascertain under what condition fowls become infected. *W. Y.*

Zschucke (Joh.). Vergleichende Untersuchungen ueber experimentelle Trypanosomiasis nach Impfung ins Blut oder in den Liquor cerebrospinalis. [**Comparative Investigations on Experimental Trypanosomiasis after Inoculation into the Blood or Cerebrospinal Fluid.**]—*Ztschr. f. Hyg. u. Infektionskr.* 1936. July 18. Vol. 118. No. 5. pp. 615–622.

With the object of examining the significance of invasion of the cerebrospinal fluid for the treatment of sleeping sickness, the author carefully compared experimental infections following inoculation of the blood and cerebrospinal fluid, respectively.

The animals used were cats, dogs and rabbits ; and the course of the disease in these animals, following blood inoculation, was compared

with that following intrathecal inoculation. The following points were specially observed :—

1. The time of first appearance of trypanosomes in the blood.
2. The time of first rise of temperature.
3. The date of the first clinical signs—oedema, glandular swellings, etc.
4. The date of appearance of nervous signs—disturbance of gait, paresis of the hind-limb, tremors, convulsions, eye lesions, etc.
5. Changes in the cerebrospinal fluid—cell count and Lange's gold curve.

The infection of cats with *T. brucei* was chosen, as the most likely to give satisfactory results, because, according to PRIEUR (1930), it runs a rather short typical course terminating with nervous phenomena. Zschucke found, however, that with his strain of trypanosomes the course of the disease varied with the number of trypanosomes injected. With large injections the disease ran an acute course to a fatal end. In order to prolong the infection and to enable the nervous signs to be studied better, it was necessary either to infect with a small number of trypanosomes, or to control the infection with small doses of Bayer 205 from time to time.

In addition to studying the above infection, the author also used *T. congolense* in cats, which, as a rule, ran a chronic course ; *T. congolense* in dogs, which ran a subacute course often with pronounced nervous signs ; and *T. gambiense* in rabbits, which presented analogies with human sleeping sickness.

The results of the numerous experiments are summarized in tables, from which it is seen that the infections resulting from blood inoculation did not differ appreciably from those following intrathecal inoculation. *W. Y.*

JANSSENS (Pierre G.). Contribution expérimentale à l'étude de l'influence du chauffage au bain-marie et des ondes courtes, seules ou en association chimiothérapique, sur une souche arsénorésistante de " Tr. gambiense." [**Experimental Study of the Influence of Heat caused by the Water Bath or Short Radiation, Alone or in Conjunction with Chemotherapy, on an Arsenic-Resistant Strain of** *T. gambiense.*]—*Rev. Belge Sci. Méd.* 1936. June–July. Vol. 8. No. 6. pp. 400–440. With 43 diagrams. [31 refs.]

The object of the experiments described in this paper was to ascertain whether it was possible to break down arsenic-resistance by means of heat. The strain of trypanosomes used was an arsenic-resistant *T. gambiense* supplied by VAN HOOF from a patient in the Belgian Congo, whose infection had resisted a course of treatment by tryponarsyl. It was passed through a Cercopithecus into guineapigs. The degree of arsenic-resistance was such that, whilst a dose of 50 cgm. per kilo. of tryponarsyl caused the trypanosomes to disappear for about 10 days, relapses always occurred : similar doses given to guineapigs infected with the normal strain produced a definite cure.

A long series of observations were performed to ascertain the thermal death point of the trypanosomes in suspension *in vitro*. In other experiments it was unsuccessfully attempted to influence the course of the infections in guineapigs by raising the temperature of the animals

by radiation with short rays, and in still others the combined action of radiation and treatment by tryponarsyl was shown to be without effect on infections caused by the resistant strain. *W. Y.*

Launoy (L.), Prieur (M.) & Ancelot (A.). Suite à l'étude d'une souche de *Trypanosoma annamense* rendue résistante à la tryparsamide. [**Further Studies of a Strain of** *T. annamense* **made Resistant to Tryparsamide.**]—*Bull. Soc. Path. Exot.* 1936. July 8. Vol. 29. No. 7. pp. 759–769.

In a previous paper [this *Bulletin*, 1936, Vol. 33, p. 203] the authors describe the method of preparation of their resistant strain, and experiments showing that it was resistant to other pentavalent and trivalent aromatic arsenicals. This general fact had been previously made known by the reviewer and his colleagues, who showed that an atoxyl-resistant strain of *T. rhodesiense* was also resistant to the usually employed aromatic arsenical and antimonial compounds and to acriflavine, but not to tartar emetic or to " Bayer 205."

Re-examination of the resistance of the authors' strain showed that it was still intact at the 77th mouse passage 10 months after it had been made resistant.

The resistance of the strain was tested against 2 complex organic arsenicals—one prepared by May & Baker, No. 529, and the other in Fourneau's laboratory, No. F. 682. There was definite evidence of resistance against the former, but the results with the latter were unsatisfactory, owing to the relatively feeble action of the compound on the normal strain. It was also found that the tryparsamide-resistant strain exhibited a certain degree of resistance to antimony-III-thiomalate of lithium.

The fact that the reviewer and his colleagues had found that an atoxyl-resistant strain was in all respects identical with an acriflavine-resistant strain suggested to the authors that they should test the resistance of their strain to gonacrine. This substance is a mixture of 60 per cent. HCl of the chloride of 3-6-diamino-10 methylacridine and of 40 per cent. of the chlorhydrate of 3-6 diaminoacridine. The experiments showed that the tryparsamide-resistant strain also exhibited resistance to gonacrine.

Experiments with moranyl showed that the tryparsamide-resistant *T. annamense* required up to double the dose necessary to cure the normal strain.

The authors conclude by stating that their conclusions are in complete accord with those of the reviewer and his colleagues, except that they have found that their tryparsamide-resistant strain exhibits a certain degree of resistance to Bayer 205. *W. Y.*

Dubois (A.). La résistance des trypanosomes aux arsenicaux aromatiques s'étend à d'autres produits aromatiques non-arsenicaux. [**Resistance of Trypanosomes to Aromatic Arsenicals extends to Other Aromatic Products which do not contain Arsenic.**]—*Ann. Soc. Belge de Méd. Trop.* 1936. June 30. Vol. 16. No. 2. pp. 173–176.

The reviewer and his colleagues have shown that a strain of *T. rhodesiense* made resistant to atoxyl or acriflavine is resistant to other aromatic compounds of arsenic or antimony, but not to inorganic

compounds of arsenic, or to tartar emetic or Bayer 205. The author has confirmed these observations in experiments conducted on another species of trypanosome, *viz.*, a Madimba strain (*T. brucei-pecaudi*).

W. Y.

Dubois (A.). Essai d'obtention d'une souche atoxyl-résistante au moyen d'un produit aromatique non arsenical et non trypanocide. [**Attempt to produce an Atoxyl-Resistant Strain by Means of a Non-Arsenical and Non-Trypanocidal Aromatic Substance.**]—*Ann. Soc. Belge de Méd. Trop.* 1936. June 30. Vol. 16. No. 2. pp. 165–172. [10 refs.]

Arising out of the work of the reviewer and his colleagues, which led them to conclude that in so-called arsenic or antimony resistance the resistance was really to the aromatic base and not to the metallic elements, the author attempted to produce a resistant strain by the use of paraminobenzoic acid. This substance contains no arsenic and is non-trypanocidal. Attempts to produce a resistant strain by *in vivo* and *in vitro* methods failed. *W. Y.*

Naito (T.) & Oka (S.). Untersuchungen ueber die Festigkeit von Trypanosomen gegen Arsenpräparate. [**Observations on the Resistance of Trypanosomes against Arsenicals.**]—*Zent. f. Bakt.* I. Abt. Orig. 1936. Nov. 9. Vol. 137. No. 8. pp. 401–418. [55 refs.]

After giving a rather lengthy review of the literature of the subject, the authors describe the preparation of strains of nagana (Prowazek) resistant to neosilversalvarsan, neosalvarsan and orsanine, respectively. The resistant strains were made in the usual way by repeated administration of subcurative doses of the drugs to infected mice. As is shown in tables a maximum resistance to orsanine was obtained after 13 passages, but maximum resistance to neosalvarsan and to neosilversalvarsan was not reached until the mouse of the 50th passage.

The reactions of these three resistant strains to a large number of arsenical and antimonial preparations were then examined. They all behaved similarly in that they were sensitive to arsenophenylglycine and solusalvarsan, and to germanin, tartar emetic and fuadin ; but they all resisted tryparsamide, myosalvarsan, the arsenopyridin compounds B R 1 and B R 23, and trypaflavine. *W. Y.*

von Jancsó (N.) & von Jancsó (H.). Beziehungen zwischen chemotherapeutischer Wirkung, Oxydationskatalyse und Redoxpotential. [**Relations between Chemotherapeutic Action, Oxydationkatalysis and Redoxpotential.**]—*Ztschr. f. Immunitätsf u. Experim. Therap.* 1936. June 26. Vol. 88. No. 3/4. pp. 275–323. [65 refs.]

The combination of chemotherapeutic substances with various chemicals in curative experiments on trypanosome infected animals frequently gives rise to interference ; this phenomenon, which is highly interesting from the chemotherapeutic and biochemical standpoint, affords a deep insight into the mechanism of chemotherapeutic action.

A new theory is advanced to explain the interference phenomenon. This states that the combinations which produce interference are those which form thermodynamic reversible redox systems, the redox potential of which belongs to a definite potential range.

In support of this theory the authors succeeded in discovering about 17 new instances of interference by substances which were chemically quite distinct, which were all reversibly reducible, and which, to a greater or less extent, inhibited the trypanocidal action of the trivalent arsenicals and antimonials.

The interference action is accordingly a characteristic attribute of electro-active bodies, which readily store up and give off electrons.

As is shown by the systematic examination of 22 chinoid redox dyes with graduated normal potentials, the activity varies gradually with the value of the normal potential.

The weakly positive and negative dyes between the potential points of the redox scale+0·115 and —0·060 vol (pH 7), *viz.*, toluyleneblue, thionin, cresylblue, gallocyanin, toluidin blue, azur I, methylene blue, pyocyanin, janus green and aethylcapri blue, all exhibit a pronounced interference action.

A distinct optimum is reached at +0·011 volt ; toluidin blue, and especially azur I, inhibit the action of even large doses of arsenoxide and fuadin.

The 8 dyes, the normal potential of which is below —0·060, were inactive.

Vitamin C exerts a strong interference action against fuadin, and this is to be explained by the fact that ascorbic acid forms a reversible redox system. Reasons are given for believing that the redox bodies act by influencing the sensitiveness of the trypanosome.

The interference of such dyes as toluidin blue, cresylblue, janus green and azur I on the trypanocidal action of arsenoxide was also confirmed by *in vitro* experiments ; the action of a 1 : 30,000 solution of arsenoxide, which normally killed trypanosomes in 1 or 2 minutes, was so far inhibited by the dyes that the parasites were still actively motile after 15 to 20 minutes.

The explanation given by the authors of the inhibitory action of the dyes is that trivalent arsenicals and antimonials damage the respiratory system of the trypanosomes, but the dyes which interfere do so by acting as accessory respiratory catalysts. *W. Y.*

Scheff (G.) & Hasskó (A.). Einfluss einiger Chemotherapeutika auf den Stoffwechsel der Trypanosomen, mit Rücksicht auf das Interferenzphänomen. [**The Influence of Certain Chemotherapeutic Substances on the Metabolism of Trypanosomes with Reference to the Interference Phenomenon.**]—*Zent. f. Bakt.* I. Abt. Orig. 1936. June 12. Vol. 136. No. 7/8. pp. 420–424.

Browning and Gulbransen have shown that parafuchsin interferes with the subsequent action of trypaflavin, and Voegtlin that sodium thioglycollate interferes with the action of salvarsan. In the present paper the authors have examined the effect of each of these 4 substances on the oxygen and sugar consumption of trypanosomes, and also the effect of the first two and the second two in combination. The general plan of their experiments was as follows. In each group 4 rats were used ; the first was given parafuchsin (or sodium thioglycollate) and exactly an hour later trypaflavin (or salvarsan), the second was given parafuchsin (or sodium thioglycollate) only, the third trypaflavin (or salvarsan) only, and the fourth served as a control. The rats were killed at intervals varying from 2 to 5 hours later, and the heart blood taken up into 3 per cent. citrate solution. The trypanosomes were

separated from the blood cells by fractional centrifugation and suspensions containing similar numbers of trypanosomes made in a medium consisting of equal parts of defibrinated sheep's blood and Locke's fluid containing 2 per cent. glucose. The oxygen consumption and the sugar consumption of these various suspensions (containing approximately equal numbers of trypanosomes) were then ascertained over periods totalling about 5 hours. The results of typical experiments are given in a couple of tables. It was found that the oxygen consumption of the trypanosomes treated with parafuchsin and trypaflavin alone was somewhat decreased, whereas the sugar consumption was greatly decreased. The suspension from the rat, which was the subject of the interference experiment, consumed about as much oxygen and sugar as the control. Similar results were obtained with the sodium thioglycollate and salvarsan experiments. *W. Y.*

i. Zolog (M.) & Comsia (O.). Nouvelles recherches sur l'action des substances arsénobenzoliques dans les trypanosomiases expérimentales. [**New Researches on the Action of Arsenobenzols in Experimental Trypanosomiasis.**]—*C. R. Soc. Biol.* 1936. Vol. 122. No. 24. pp. 1132–1134.

ii. —— & ——. Rôle du système réticulo-endothélial dans le mécanisme chimiothérapique des corps arsénobenzoliques. [**Rôle of the Reticulo-Endothelial System in the Chemotherapeutic Mechanism of Arsenobenzols.**]—*Ibid.* pp. 1135–1137.

iii. —— & ——. Système réticulo-endothélial et action thérapeutique des corps arsénobenzoliques. [**The Reticulo-Endothelial System and the Therapeutic Action of the Arsenobenzols.**]—*Ibid.* pp. 1138–1140.

i. This work was undertaken in order to ascertain whether neosalvarsan acted directly on trypanosomes, or whether it was first converted into toxalbumen in the liver, or whether it was reduced. The experiment consisted in filling a collodion sac, which was permeable to albumen, with a suspension of *T. equiperdum*, and then implanting this in the peritoneal cavity of white rats, which also received an intraperitoneal injection of trypanosomes. The animals were then injected subcutaneously with the drug, and after various intervals killed, and the condition of the parasites in the peritoneal cavity and in the collodion sac examined. It was found that those free in the peritoneal cavity were destroyed before those in the sac. In a second series of experiments the drug was injected into the collodion sac containing the trypanosomes. In this case the parasites in the sac were destroyed before those free in the peritoneal cavity. In a third series the drug was placed in a separate collodion sac. The conclusions are that toxalbumen is not the therapeutic substance and that reduction is not essential.

ii. Experiments were undertaken to ascertain the effect of blockade of the reticulo-endothelial system on the therapeutic action of neosalvarsan in mice infected with *T. equiperdum*. It was found that contrary to the experience of previous workers, blockade by heavy doses of Chinese ink or electro-colloidal copper enhanced the therapeutic action of the drug ; the authors explain this phenomenon on the hypothesis that the blocked animals had a higher concentration of drug in the blood.

iii. The experiments here described were performed in order to discover whether an intense blockade or destruction of the reticulo-endothelial system coinciding with the infection of the animals had any effect on the ultimate chemotherapeutic process. It was found that Chinese ink or electro-colloidal copper administered shortly before infection with *T. equiperdum* had no effect on the evolution of the disease. Blockade by Chinese ink previous to infection, and preceding the administration of the drug by 3 days, exerted a favourable influence on the treatment. Electro-colloidal copper given before infection and followed 3 days later by the drug produced a slight reduction in the parasitic effect of the medicament ; this is in contrast to what happens when the injection of the copper shortly precedes treatment. *W. Y.*

Schern (Kurt) & Artagaveytia-Allende (Ricardo). Zur glykopriven Therapie und Prophylaxe mit sowohl toxisch als auch atoxisch wirkenden Substanzen bei der experimentellen Trypanosomen- und Treponemen-Infektion. [**On Hypoglycaemia Therapy and Prophylaxis with Toxic and Atoxic Acting Substances in Experimental Trypanosomal and Spirochaetal Infections.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Sept. 18. Vol. 89. No. 1/2. pp. 21–64. [32 refs.]

The authors refer in considerable detail to previous work on the disturbance of carbohydrate metabolism which occurs in trypanosomal infections. Consideration of this work caused them to inquire whether it might not be possible to influence trypanosomal infections by the administration of substances which caused a hypoglycaemia. It was found, however, that such substances as phosphorus, phloridzin, insulin and urethane, failed to cure *Trypanosoma equinum* infections ; starvation was likewise without influence. Synthalin, however, had a curative action not only on *Trypanosoma equinum* infections, but also on infections due to *Treponema hispanicum.*

The authors conclude that the curative action of synthalin is not due to the fact that it produces a hypoglycaemia, but is in part due to a toxic action on the parasites. It was found that synthalin has no action on *T. cruzi* infections. [This paper should be read in conjunction with that of von Jancsó, who likewise found that synthalin exercises a curative action on trypanosomal infections ; *vide* this *Bulletin*, 1936, Vol. 33, p. 204.] *W. Y.*

Kligler (I. J.) & Olitzki (L.). **The Antigenic Composition of** *Trypanosoma evansi.*—*Ann. Trop. Med. & Parasit.* 1936. Oct. 21. Vol. 30. No. 3. pp. 287–291.

This paper presents the results of a preliminary series of antigenic analyses made with *Trypanosoma evansi.* The blood of highly infected rats was taken into glucose citrate solution and the washed trypanosomes obtained in the usual method by fractional centrifugation ; the packed sediment was dried *in vacuo* over $CaCl_2$. The material from 10 rats weighed about 50 mgm., an amount found to be sufficient for the various tests and analyses.

The analysis was made as follows :—The dried material was suspended in alcohol (25 cc. of 96 per cent. alcohol to 50 mgm. of trypanosome substances), and extracted for 2 days at 30°C. The suspended material was then removed by the centrifuge and suspended in 15 cc.

of ether and extracted for 48 hours at 20°C. The ether was removed and the residue dried and weighed. It was then taken up in N/2NaOH, heated to 37°C., and filtered. The solution was treated twice with 2 volumes of absolute alcohol, and the second precipitate, which represented the C or carbohydrate substance, was centrifuged, dried and weighed. In another lot the residue obtained, after the alcohol and ether extraction, was analysed for N.

In this manner 4 fractions were obtained: (1) alcohol soluble, (2) ether soluble, (3) protein residue, and (4) C or carbohydrate fraction. The results of the analyses are shown in tables and are compared with similar analyses of Shiga's dysentery bacillus.

The following are the conclusions reached:—

"The trypanosome studied (*T. evansi*) differs basically in its antigenic composition from bacteria: nearly 60 per cent. of the trypanosome cell is lipoidal in nature and extractable with alcohol and ether and only 2–6 per cent. C substance; in contrast to this, the bacterial cell contains 14–16 per cent. C substance and only 12–15 per cent. lipoids.

"The C substance of bacteria is readily hydrolysed by N/1HCl in 30 minutes, while that of the trypanosome is only partially hydrolyzed by heating for 2 hours with 2N/HCl.

"The various fractions of the trypanosome are non-toxic as tested by the Schwartzman phenomenon.

"The injection of the lipoid fraction into rats produces a positive Wassermann reaction, but does not enhance resistance to infection.

"It is suggested that the antigenic peculiarities of the trypanosome are ascribable to the lipoids which constitute the major part of the cell."

W. Y.

Kroó (H.). Die spontane, apathogene Trypanosomeninfektion der Kaninchen. [**Spontaneous Apathogenic Trypanosome Infection of Rabbits.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. May 30. Vol. 88. No. 1/2. pp. 117–128. With 2 figs.

There is little reference in the literature to spontaneous trypanosomal infection of the rabbit. The author encountered such an infection and made a careful study of the parasite. *Trypanosoma nabiasi* is morphologically indistinguishable from the rat trypanosome. Division forms, other than forms with a double blepharoplast which were exceedingly common, were not found in the peripheral blood. The trypanosome was readily cultured on N.N.N. medium at room temperature.

The infection appears to be widespread in the region of Madrid and in North-West Africa. Of 370 tame rabbits examined, no less than 122 (32·9 per cent.) harboured trypanosomes. The infections were much commoner in the summer months (43 per cent.) than in the spring (17·2 per cent.). Brumpt classifies *T. nabiasi* amongst the trypanosomes which are transmitted through the dejecta of fleas. As a rule, a large proportion of infected animals is only encountered when fleas are present. Amongst the standard animals raised at the Institute of Animal Biology at Madrid no trypanosomes were found in 9 adult and 14 young rabbits, whereas among rabbits infested with fleas 5 of 13 adults and all of 8 young animals were infected. Pregnant rabbits, which had recovered from the infection, were cleared of fleas and placed in an insect-proof room. Their young, 43 in number, which were found to be free from trypanosomes, were placed in intimate contact with infected rabbits, and within a month had all become infected.

From this it is concluded that under favourable conditions all young animals become infected, and that the incubation period is about 2 weeks.

In natural infections the concentration of trypanosomes in the blood reaches its maximum (3–10 to a field) in 3 to 5 days. The number remains more or less constant for a long time (52–218 days) and the infection then terminates by crisis or more slowly during several days. Relapses do not occur ; and the animals show no signs of disease. In artificial infections the number of trypanosomes in the blood is smaller and the duration shorter ; subinoculations often fail.

Animals which have recovered from the infection are immune. The serum of such animals contains a trypanocidal substance, the action of which can be demonstrated *in vitro*. Certain therapeutic observations showed that *T. nabiasi* differs from other non-pathogenic trypanosomes in that it is susceptible to the action of such compounds as atoxyl, arsenophenylglycin, neosalvarsan, stibosan and germanin. Details of these observations are given in a table. *W. Y.*

Collier (W. A.) & Verhoog (M. J.). Ein " Goldphänomen " bei der Trypanosomeninfektion der Maus. [**A Gold Phenomenon in Trypanosomal Infection of the Mouse.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Aug. 4. Vol. 88. No. 5/6. pp. 509–528. With 13 figs.

Generally speaking gold preparations act more or less favourably on spirochaetal and coccal infections, but not on trypanosomal infections. The phenomenon described by the authors is that certain gold preparations, which are themselves inactive in trypanosomal infections, can nevertheless render the infection more sensitive to true trypanocidal medicaments.

The gold preparations used were (1) Auro-Detoxin (Type 70), which has been shown to be active in streptococcal and pneumococcal infections in rabbits ; (2) Auro-Detoxin, which is very active in streptococcal infections of the mouse, and, like the previous compound, active in *Spirochaeta recurrentis* infections ; (3) Lopion, which is relatively non-toxic and has a slight action on *Sp. recurrentis* ; and (4) Krysolgan, which is highly toxic and has a slight action on *Sp. recurrentis*.

The results, which are given at length, show that the previous or simultaneous administration of all these gold compounds enhanced the action of various arsenical compounds, Bayer 205 and trypaflavine ; they did not increase the action of tartar emetic however. This increase in activity was also observed with a salvarsan-fast strain of trypanosomes. *W. Y.*

Trillat (A.). Guérison d'une trypanosomiase expérimentale chez la souris par inhalation de vapeurs de Moranyl. [**Cure of Experimental Trypanosomiasis in the Mouse by Inhalation of Moranyl.**]—*Bull. Acad. Méd.* 1936. July 21. 100th Year. 3rd Ser. Vol. 116. No. 27. pp. 75–77.

Mice infected with *T. brucei* were exposed under a bell-jar of 20 litres capacity to an invisible cloud of a 10 per cent. solution of moranyl. It was found that inhalation of relatively short duration and of very small doses of the solution sufficed to arrest the infection, *e.g.*, inhalation of 0·75 mgm. per 25 gm. of mouse prevented any relapse during an observation of a month. *W. Y.*

Soulié (P.). Sur une nouvelle trypanosomose équine en Syrie. Considérations épidémiologiques. Essai d'identification. [**On a New Equine Trypanosome of Syria.**]—*Bull. Soc. Path. Exot.* 1936. July 8. Vol. 29. No. 7. pp. 777–785. With 2 figs.

An account is given of a trypanosome discovered in a number of horses in north Syria, which the author believes to be *T. evansi*.

W. Y.

American Trypanosomiasis.

Kofoid (Charles A.). **American Trypanosomiasis. The Northward Extension of Brazilian Trypanosomiasis, or Chagas' Disease, among Mammals in California.—Fifth Pacific Science Congress.**—pp. 3075–3078.

This short paper contains nothing new. It emphasizes the fact that the endemic infection of *Triatoma protracta* is, so far as is known, localized in California to bugs living in the nests of wood rats. *T. protracta* is found as far north as northern California and Utah, and the wood rats extend further north into southern Oregon. It thus appears possible that human trypanosomiasis has a potential extension throughout the tropical and temperate Americas on the Pacific Coast. *W. Y.*

Mazza (Salvador). Nota sobre el primer centenar de formas agudas de enfermedad de Chagas comprobadas en la República por la Misión de Estudios de Patología Regional Argentina. [**The First Hundred Cases of Chagas's Disease in the Argentine.**]—*Prensa Méd. Argentina.* 1936. Aug. 19. Vol. 23. No. 34. pp. 1979–1981. With 1 map.

This article analyses 109 acute cases of American trypanosomiasis observed by a Commission from the University of Buenos Aires in 1932. The article cannot be abstracted, but the following remarks may be useful. A sketch map indicates the Provinces with the number of cases in each. In the littoral Provinces there were 31, of which 27 were in Santa Fé and two each in Entre Rios and Corriente ; in the Northern 39, *viz.*, 14 in Santiago del Estero, 10 each in Chaco and Jujuy, 4 in Salta and 1 in Formosa ; in the central zone, Córdoba, 2 ; in the West 37, *viz.*, 22 in Mendoza, 10 in Catamarca, 3 in La Rioja and 2 in San Juan. Seven deaths occurred among the 109 cases ; 4 among the 27 in Santa Fé, one each in Santiago del Estero, San Juan and Mendoza. *H. H. S.*

Mazza (Salvador). Investigaciones sobre la enfermedad de Chagas. Comprobaciones de casos agudos de enfermedad de Chagas en nuevas partes de la zona biológica chaqueña (Formosa, Chaco, Salteño). Hallazgos epidemiológicos especiales de la región. [**Chagas's Disease. Cases in Fresh Districts of Chaca.**]—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy.* 1936. Publicación No. 27. 48 pp. With 38 figs. [20 refs.]

Every few weeks reports are received of new districts in which cases of infection by *T. cruzi* are discovered so that they no longer excite

much interest. The disease is probably widespread in South America, in Brazil, the Western Argentine, Venezuela, Guatemala and elsewhere. The chief point of interest in this article is the description of *Psammolestes coreodes* as the vector, the comparison between the various descriptions of it by different authors (which is presented in a table) and the discussion as to whether it is a valid species or not. *H. H. S.*

Niño (Flavio L.). Verbreitungsgebiet der Triatomidae (Hemipt.-Heteropt.) in Argentinien und Beschreibung einer neuen Art. [**Distribution of** *Triatomidae* **in the Argentine with a Description of a New Species.**]—*Ztschr. f. Parasitenk.* 1936. Aug. 3. Vol. 8. No. 5. pp. 606–610. With 2 figs.

Triatoma infestans occurs all over the Argentine between the Andes in the West and the Atlantic, the La Plata and Uruguay in the east, and between a line 22°S. in the north and 41°S. in the south. *Triatoma infestans* is the most widespread member of the family, but about 10 other species are also found. In a table is given the percentage of *Triatoma infestans* found to be infected with *Trypanosoma cruzi* in the various provinces. The paper concludes with a brief discription of a new species, *Triatoma rosenbuschi* Mazza, 1936. [Mention of this species has already been made in this *Bulletin*, 1936, Vol. 33, p. 676.]

W. Y.

Rozeboom (L. E.). *Triatoma dimidiata* **Latr., found Naturally Infected with** *Trypanosoma cruzi* **Chagas in Panama.**—*Amer. Jl. Trop. Med.* 1936. July. Vol. 16. No. 4. pp. 481–484.

Bugs collected in one of the poorer houses in the town of Chorrera about 21 miles west of Panama City were found to be infected with *T. cruzi*. These bugs were identified by N. G. Barber as *Triatoma dimidiata* Latr. and are the fourth Reduviid incriminated as a vector of Chagas's disease in this region. The other known vectors are *Triatoma geniculata*, *Rhodnius pallescens* and *Eratyrus cuspidatus*.

W. Y.

Kofoid (Charles A.) & Whitaker (Bruce G.). **Natural Infection of American Human Trypanosomiasis in Two Species of Cone-Nosed Bugs,** *Triatoma protracta* **Uhler and** *Triatoma uhleri* **Neiva, in the Western United States.**—*Jl. Parasitology.* 1936. June. Vol. 22. No. 3. pp. 259–263.

The discovery of *T. cruzi* in *Triatoma protracta* by Kofoid and McCulloch in 1916 was the first report of the occurrence of the causative organism of Chagas's disease in the United States. In the present paper the authors report the discovery of the trypanosome in a second species of cone-nosed bug, *Triatoma uhleri*, Neiva, collected in the vicinity of Tucson, Arizona. The infected bugs were found in houses and in beds.

W. Y.

Galliard (Henri). Recherches sur les reduvidés hématophages *Rhodnius* et *Triatoma*.—*Ann. Parasit. Humaine et Comparée.* 1935. July 1, Sept. 1 & Nov. 1. Vol. 13. Nos. 4, 5 & 6. pp. 289–306; 401–423; 497–527, & 1936. Jan. 1, Mar. 1 & May 1. Vol. 14. Nos. 1, 2 & 3. pp. 1–34; 97–112; 193–205. With 57 figs. [79 refs.]

Dias (Emmanuel). O " Signal de Romaña " e os novos progressos no estudo da doença de Chagas. [**Romaña's Sign in Chagas's Disease.**] —*Folha Med.* 1936. July 25. Vol. 17. No. 21. pp. 345–347. With 2 figs.

Romaña's sign, so-called after Dr. Cecilio Romaña who first described it, has the following characteristics.

1. Swelling of lids and conjunctiva of one eye, usually sudden in onset.
2. Painless oedema and a reddish-violet discoloration of the lids.
3. Hyperaemia and oedema, even to actual chemosis, of the conjunctiva, but cornea not affected, and conjunctival secretion scanty.
4. Extension of the swelling on the same side.
5. Enlargement of correlated glands, pre-auricular, parotid or submaxillary.
6. Slow subsidence of the swelling.

The author does not state in so many words that the site of the swelling is incidental to the primary lesion, *i.e.*, accidental when the bug bites the region in question. The sign is evidently fairly common, " llamativo " as the Argentines call it, that is " pathognomonic."

H. H. S.

Romaña (Cecilio). Relato y comentarios acerca de tres casos agudos de enfermedad de Chagas.—*Folha Med.* 1936. July 25. Vol. 17. No. 21. pp. 314–319. With 4 figs.

Kelser (R. A.). **A Complement-Fixation Test for Chagas' Disease employing an Artificial Culture Antigen.**—*Amer. Jl. Trop. Med.* 1936. July. Vol. 16. No. 4. pp. 405–415. [12 refs.]

A complement fixation test for Chagas's disease is described ; this is a modification of the Machado reaction, the essential difference being that the author employed an artificial culture of the trypanosomes as antigen instead of infected organs.

Kelser points out that earlier work had shown that the extent of infection of the organs and the potency of the antigens made from them varied markedly. He at first therefore attempted to produce conditions in experimental animals which would render them more susceptible to the disease, with the hope that there would be a marked increase in the number of parasites in the blood. Such measures consisted in subjecting the experimental animals to heavy doses of X-ray, in blocking of the reticulo-endothelial system by colloidal copper, and in splenectomy ; but as all these methods failed to accomplish the desired results, the author attempted to produce a satisfactory antigen by the use of artificial cultures of *T. cruzi*.

The medium used was a slight modification of that described by Bonacci (No. 4 preparation) for the propagation of *T. cruzi* [this *Bulletin*, 1935, Vol. 32, p. 721]. Kelser used the desiccated media ingredient prepared by the Difco Laboratories (Detroit, Mich.) and the details of preparation of his medium are as follows :—

To a flask containing 500 cc. of distilled water, 25 gm. of dehydrated " Bacto-Beef " are added and the flask placed in a water-bath at 55°C. for 1 hour ; then 12·5 gm. of " Bacto-peptone " and 3·5 gm. of sodium chloride are added and the mixture after boiling for 5 minutes is filtered through absorbent cotton. The broth is made neutral to litmus by the addition of N/1 sodium hydroxide solution. It is then measured, placed in a boiling water bath, and 1·0 per cent. granular " Bacto-agar " added.

As soon as the agar has dissolved, the medium is distributed without filtering into sterile test tubes or 50 cc. Erlenmeyer flasks, 5 cc. being placed in each test tube and 10 cc. in each flask. Sterilization is accomplished by autoclaving at 12 pounds pressure for half an hour. This base is stored in the refrigerator, and when ready for use the tubes or flasks are placed in a boiling water bath until the agar is melted ; the temperature is then lowered to 50° to 55°C. and to each tube are added 0·25 cc. of a sterile 1 per cent. solution of dextrose and 0·25 cc. of fresh, defibrinated guineapig blood ; the tubes are then slanted so as to give a relatively small slanted surface to a deep butt. In the case of the flasks twice as much dextrose solution and blood are added and the medium permitted to harden at the bottom of the flasks. Before inoculation of the flasks, the small amount of water of condensation in each is augmented by the addition of 2 cc. of a mixture of 1 part of 1·0 per cent. sterile dextrose solution and 2 parts of peptone broth made as described for the preparation of the basic medium. This is unnecessary, as a rule, in the case of the tubes, but as the cultures become older, 0·10 cc. of the dextrose broth medium can be added where there is a danger of complete loss of the water of condensation through evaporation.

The cultures, which are incubated between 24° and 30°C., are transplanted at approximately 10-day intervals, although most cultures survive a month or more if they are not allowed to become dry. Occasionally, the cultures were passed through young guineapigs. These animals and rats are readily infected with the culture and the organism can easily be recultivated from them.

In order to start a culture 0·2 cc. of defibrinated blood of an infected animal is inoculated into the water of condensation in a culture tube. Leishmania forms, growing in clusters, are usually seen in from 3 to 5 days, and a few days later large numbers of flagellated forms are to be found. In subcultures the growth becomes very heavy within a week and can be seen as a white deposit in the lower part of the water of condensation.

As a single flask usually yields as many organisms as 5 to 6 tubes it is more convenient to prepare the antigen from flask cultures. The fluid portion of each flask is drawn off : 1 cc. of distilled water is added to the flask to wash up the remaining organisms, and this is then withdrawn and added to the previously removed fluid. The trypanosomes are deposited by means of a high speed centrifuge, the supernatant fluid removed and the trypanosomes washed in sterile physiological saline. To the washed organisms are added two volumes of 50 per cent. glycerine in physiological saline and the mixture allowed to stand in the refrigerator for 24 hours. For titration the stock antigen is diluted with 20 or 25 parts of physiological saline. When kept at low temperatures the antigen is usable for as long as a month, but there is a drop in titre as it ages. The antigen should be titrated within a day or two of its use in testing serum specimens.

An account is given of the method adopted for the titration of the antigen and for the performance of the test. It is recorded that this complement-fixation test has been used in testing over 400 serum specimens including a number from known cases of Chagas's disease in man and lower animals. It has proved positive in all known cases of the disease from which sera were available, and negative where there was no evidence of Chagas's disease. No cross reactions occurred with Wassermann-positive sera ; and serum specimens from guineapigs infected on *T. equiperdum* gave no reaction when tested with the antigen. *W. Y.*

MALARIA.

BARBER (M. A.). **A Survey of Malaria in Cyprus.**—*Amer. Jl. Trop. Med.* 1936. July. Vol. 16. No. 4. pp. 431–445. Also in *Cyprus Ann. Med. & San. Rep., 1935.* Appendix D. pp. 62–69.

This is an interesting and informative record of a survey that was carried out between June 22 and August 2, 1935, during which nearly all parts of the island were visited. Twenty-five villages were carefully surveyed. Of the combined village population of 13,474, children to the number of 1,089 were examined. These showed a parasite rate of 36·6 per cent. and a spleen rate (Ross method) of 40·9. These figures are evidence of the large amount of malaria in the island. The opinion is expressed that a survey in September or October would reveal higher indexes.

Of the 399 positive blood films 33·3 per cent. were *vivax*, 42 per cent. *falciparum* and 24·5 per cent. *malariae*. There was no definite association of a species of malaria parasite with the species of *Anopheles* prevalent in the village. The two chief malaria vectors are *elutus* and *superpictus*. No *maculipennis* were found though thorough search was made. *A. bifurcatus* was found at high elevations. *A. multicolor* was present but not in large numbers. No close relation was noted between the density of anophelines and the amount of malaria at the time of visit.

The results of mosquito dissection were as follows :—

Species.	No. dissected.	Sporozoite positive per cent.
A. elutus	428	1·8
A. superpictus	1,134	7·8
A. multicolor	37	0·0

The percentage of positive findings amongst *superpictus* is far greater than that found in Greece and exceeded that found by the author among *A. costalis* in West Africa. There appeared to be, however, less malaria transmission by a given percentage of infected *superpictus* than by the same or a lower percentage of infected *elutus*.

The precipitin test with the stomach contents of anophelines gave interesting results : deviation of mosquitoes to domestic animals is less in evidence than in many malarious countries. Thus of 150 *elutus* (of which 17 were caught in stables) which gave a positive reaction 82·6 per cent. were positive for man. The number of cattle and other domestic animals in the villages at night is small.

The amount of malaria in Cyprus is out of proportion to the relatively small amount of water available for anopheline breeding during the rainless summers. The author agrees with the conclusion of Ross that in Cyprus an attack on the mosquitoes is the measure most likely to give the best results. *Norman White.*

BARBER (M. A.), RICE (J. B.) & MANDEKOS (A. G.). **The Relation of the Density of the Anopheline Mosquitoes and the Transmission of Malaria.**—*Amer. Jl. Hyg.* 1936. Sept. Vol. 24. No. 2. pp. 237–248.

The observations described were undertaken in two groups of villages in Greek Macedonia, one in the Nestos Valley near the sea, an area of high endemicity, the other in the plain of Philippi, where

endemic malaria is less severe. The inquiry was restricted to *Anopheles elutus* (*sacharovi*). *A. maculipennis* (*typicus* and *messeae*) was almost as prevalent but it was found to possess so high a deviation to domestic animals that the rôle it plays in the transmission of malaria must be unimportant. From 1932 to 1935 the malaria parasite index of infants under one year of age was compared with the density of *A. elutus*. The density index is the average number of adult mosquitoes per collection in village houses and stables.

It was found that malaria transmission was more or less proportional to the density of *elutus*. There was a lower limit of density, measurably above the extinction point, at which transmission nearly ceased. During the earlier years of the inquiry the sporozoite index was nearly the same in the areas of high and low *elutus* density respectively. The authors realize that an approximation is all that can be expected in an inquiry of this kind: numerous factors are involved, some of which are difficult to measure. Such approximations are, however, of value in appraising the value of antimalaria work. *N. W.*

Jackson (R. B.). **Investigations into the Habits and Pathogenicity of the Anophelines met with in Two Localities in Hong Kong during 1931–1935.**—*Chinese Med. Jl.* 1936. Aug. Vol. 50. No. 8. pp. 1098–1113. With 2 maps.

Two circumscribed areas in Hong Kong have been kept under special observation for five years with the object of studying the breeding, seasonal prevalence and habits of anophelines. In one, Pokfulam, *A. maculatus* was most in evidence. Though a recognized carrier of malaria and easily infected in the laboratory, it plays no part in the spread of malaria in this area. Precipitin tests showed that cattle were the chief source of its food supply. The breeding of *A. minimus* was localized and restricted to certain months of the year; malaria infections were likewise restricted to the neighbourhood of *minimus* breeding places. This species appeared to be the only vector of importance.

In the second area, Little Hong Kong, in addition to the two species already mentioned *A. jeyporiensis*, *A. hyrcanus* and *A. tesselatus* were found. The last named was rare; one specimen taken had a midgut infection. *A. minimus* and *A. jeyporiensis* were both found to be important carriers of malaria. Both were also found harbouring filaria apparently derived from human sources. *N. W.*

Earle (W. C.). **The Relative Importance of *Anopheles tarsimaculatus*, *Anopheles argyritarsis*, and *Anopheles pseudopunctipennis* as Vectors of Malaria in the Windward Group of the West Indies.**—*Amer. Jl. Trop. Med.* 1936. July. Vol. 16. No. 4. pp. 459–469.

This is a record of observations made in the islands of Grenada and St. Lucia. In the former very heavy rainfall in a mountainous island limits malaria to a relatively small part of the coastal belt. In St. Lucia there are swampy areas adjacent to towns and two heavily populated river valleys in which parasite indexes over 50 per cent. were found.

A. tarsimaculatus was present wherever there was malaria ; it was readily found in human dwellings, showed a predilection for human blood, was found infected and was readily infected in the laboratory. It appeared to be responsible for most if not all of the malaria in the two islands.

A. argyritarsis was less prevalent. It was much less often found in houses and has a less marked preference for human blood. It is, however, easily infected in the laboratory.

A. pseudopunctipennis was found in Grenada but not in St. Lucia. Its distribution was not closely related to that of malaria : it is most prevalent when malaria is least in evidence. It is not easily infected in the laboratory. It is probably of no importance as a vector of malaria in Grenada. *N. W.*

Schourenkova (A.) & Mekhanikova (V.). La répartition des espèces de l'hématozoaire du paludisme dans certains foyers endémiques du Tadjikistan. [**Distribution of the Different Species of Malaria Parasites in Tadjikistan.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1936. Vol. 5. No. 3. [In Russian pp. 379–392. French summary p. 393.]

The authors have examined the population of three villages in Tadjikistan (Middle Asia), with a total of 600–800 inhabitants, every three months during the years 1935–1936, with the view of establishing the seasonal and age distribution of the malaria parasites. In the course of these examinations all the recognized malarial indices were recorded. The present paper contains an analysis of the specific distribution of the parasites. The distribution curve shows two peaks, one in spring and the other in autumn. In spring *P. vivax* and *P. falciparum* are present in equal numbers, in autumn the M.T. form is predominant. The quartan parasite is rarely encountered and never in summer. The spring increase of the parasite-index is due chiefly to infections in children (3 to 5 years old), in autumn the incidence amongst children and adults is about the same, B.T. being prevalent in the former and M.T. in the latter. The only local vector is *Anopheles superpictus*. *C. A. Hoare.*

Colonial Development Fund (Malaria Research Scheme). **Report of the Malaria Unit, Tanga, 1933–34, together with a Report on a Study of Malaria in India** [Wilson (D. B.), M.A., B.Ch., M.R.C.S., etc.].—71 pp. With 4 maps & 16 figs. [11 refs.] 1936. Dar es Salaam : Govt. Printer. [Shs. 10*s*.]

The most interesting part of this Report was embodied in a paper by Dr. Wilson entitled Rural Hyperendemic Malaria in Tanganyika Territory, which has been summarized already in this *Bulletin*, 1936, Vol. 33, p. 765. In Tanga itself and also in Arnani, though there is a good deal of malaria there is very little transmission, the inhabitants who are always on the move contract the disease outside the townships. The greater part of the occupied area on Kilimanjaro is healthy, but there are areas at the foot of the mountain, such as Taveta, which are very malarious, and in some the conditions of malaria in mixed communities obtain ; one of these is a part of Moshi township. The

principal carrier everywhere is *A. gambiae*, which loves still or slowly moving water open to the sun. *A. gambiae* constituted seven-eighths of the anopheline infestation found during this survey. The other important anopheles is *A. funestus*, which breeds in places lying out of the sun, under vegetation. Its comparative uncommonness in the places investigated is attributed by the author to lack of suitable breeding places. *W. Fletcher.*

Bishop (E. L.). **Malaria-Control Activities of the Tennessee Valley Authority.**—*Public Health Rep.* 1936. July 17. Vol. 51. No. 29. pp. 970–975.

Very few large-scale engineering enterprises have been undertaken with as much forethought for the possible public health consequences of the undertaking as is disclosed in this short report of the Director of Health of the Tennessee Valley Authority. All concerned in the enterprise take into account measures designed to prevent mosquito breeding that might increase the transmission of malaria along the 2,300 miles of impounded reservoir shore line. The report describes the manner in which the consideration of engineering and public health problems is co-ordinated. *N. W.*

Blacklock (D. B.). **Studies in Rural Hygiene in the Tropics. II. The Cultivation of Dense Shade Plants as an Anti-Malaria Measure.** —*Ann. Trop. Med. & Parasit.* 1936. July 17. Vol. 30. No. 2. pp. 181–186. With 3 figs. on 1 plate.

In many parts of Assam both surface and sub-surface drainage has failed as an anti-malaria measure. It has, indeed, in some places, made matters worse. This experience is in striking contrast with that of Malaya. Among the reasons advanced to explain the failure are the much heavier rainfall of Assam, concentrated within a period of a few months, and the flatness of the ground, making it difficult or impossible to get sufficient fall. Contour open drains may be washed out by heavy rain and made dangerous. Sub-surface drains fail to deal with the great volume of water. The drainage has lowered the surface water in places ; what were impassable swamps are now used for rice cultivation but the prevalence of *A. minimus*, the chief vector, has been increased. The fundamental reason for failure is probably the lack of sufficient fall in the tributaries of the large rivers and in the large rivers themselves.

In areas where drainage has failed shading streams with dense artificial shade is meeting with success where the chief vector is *A. minimus*. In Assam many plants have been used for this purpose including Basak, Lantana, Eupatorium, Tarapat, Hibiscus, Durantha and Bamboo. The shade must be really dense, excluding sun from the water so that no green vegetation grows in it. Such vegetation, to which the larvae can cling with their tail-hooks, would seem to be necessary for *A. minimus* : in the absence of this the larvae will be washed away. The natural jungle cover does not usually provide sufficiently dense shade. Really dense shade of the nature described might eliminate the breeding of many other species, even shade-breeding species, in other parts of the world. In any case a thorough experimental trial in suitable places would seem to be worth while.

N. W.

Williams (L. L.), Jr. **Factors concerned in Malaria Control by Drug Treatment.**—*Southern Med. Jl.* 1936. July. Vol. 29. No. 7. pp. 743–746. [12 refs.]

In this, the Chairman's address to the National Malaria Committee, an attempt is made to weigh the value of the attempts that have been made to control malaria through drug administration. It is pointed out that in any such attempt consideration must be given to finding the infected individuals ; curing the infection ; preventing relapses (or preventing carriers from infecting mosquitoes) and preventing the importation of new cases. Reference is made to many of the outstanding reports dealing with this question that have been published during recent years, summaries of which have been published in this *Bulletin*. The conclusion of this interesting address is that " malaria control through the administration of drugs is not a hopeful procedure. Successful in reducing clinical attacks of malaria, it offers little hope for controlling the malaria rate, is difficult to apply, and is uneconomical." *N. W.*

Swellengrebel (N. H.), de Buck (A.), Schoute (E.) & Kraan (M. H.). **Investigations on the Transmission of Malaria in Some Villages North of Amsterdam.**—*Quarterly Bull. Health Organisation. League of Nations.* Geneva. 1936. June. Vol. 5. No. 2. pp. 295–352. With 3 figs., 2 diagrams & 5 maps.

In the villages of Wormerveer, Uitgeest and Marken, malaria transmission is limited to the autumn, semi-hibernating *A. maculipennis atroparvus* being alone responsible.

With some rare exceptions infection of *A. maculipennis atroparvus* is limited to females which have entered upon their term of semi-hibernation in the second half of August. The scarcity of infections in the summer is not entirely due to the mosquitoes entering stables at that time but is considered by the authors, in accordance with James's experiments, to be the result of the shortened span of life at that season associated with sexual activity. *A. maculipennis messeae* (identified by the rod-like form of the salivary glands) shares its autumnal quarters with *atroparvus*, but only once was a female found infected. Autumnal infections of *atroparvus* are most numerous in houses which contain many children under 16, among whom there are carriers of plasmodia without obvious clinical symptoms (" healthy " carriers). Houses of this type may remain foci of anopheline infection for at least two successive autumns without fresh cases of malaria occurring in them. The infected *Anopheles* show little tendency to move to neighbouring houses. During the winter the oöcysts and sporozoites degenerate ; this process begins in November and is so far advanced by January that the mosquitoes are no longer infective. The authors recommend the spraying of houses once a fortnight from the middle of August to the end of October to control autumnal infection ; the work to be done preferably by trained personnel. Where rigorous economy is needed, the operations may be confined to houses containing numerous children under 16. The authors emphasize that treatment of malaria will not prevent anopheline infection if, as often happens, the relapses are not severe enough to make the patient seek medical advice, so that he becomes a " healthy " carrier. They attach more importance to such carriers than to malaria patients as sources of infection. *V. B. Wigglesworth.*

Landeiro (F.) & Cambournac (F.). O sezonismo em Portugal.—Colecção de Relatórios, Estudos e Documentos Coloniais. [**Malaria in Portugal.**]—7th Ser. No. 28. 142 pp. With 34 figs., 3 folding maps & 1 chart. [21 refs.] English summary. 1935. Lisbon : Divisão de Publicações e Biblioteca, R. da Prata, 34.

This is a well documented report on the geographical distribution and prevalence of malaria throughout Portugal. Malaria is a serious cause of morbidity in the River basins of the Sado, the Tagus (including the upper reaches of the Guadiana), the Mondego and the upper Douro. Elsewhere endemic areas are more circumscribed. The highest spleen index (95 per cent.) and the highest parasite index (34 per cent.) were both found in the Setúbal District near the mouth of the Sado. The only anophelines found in Portugal are *A. maculipennis atroparvus, A. maculipennis maculipennis* (*typicus*) and *A. bifurcatus*. Of these *atroparvus* alone appears to be of importance as a vector of malaria in Portugal. It was found alone in the areas of most severe malaria. Malaria in Portugal is intimately associated with rice cultivation. A floating labour population plays an important part in the spread of the disease. *N. W.*

Barber (M. A.), Mandekos (A.) & Rice (J. B.). **The Seasonal Incidence of Malaria Transmission in Macedonia.**—*Amer. Jl. Hyg.* 1936. Sept. Vol. 24. No. 2. pp. 249–267. With 1 chart.

This very interesting study is based, for the most part, on the examination of 1,578 infants of one year or less in 31 villages of Greek Macedonia and 14 villages in the plain of Lamia during the years 1932–1935 inclusive. The great majority of the examinations were made in Macedonia. The authors remark that the possibility of prenatal infection cannot be wholly excluded : of 44 children under 10 days of age examined one, aged 7 days, had numerous rings of *P. falciparum* in the peripheral blood. The occurrence is, however, a rare one in Macedonia. For the purpose of the inquiry 10 days was taken as the minimum incubation period.

It was found that very little transmission, possibly none through anophelines, takes place between December and April ; transmission does occur in May and June and reaches its maximum in July, August and September. There is a very small amount of transmission in October and November.

P. vivax predominates in the spring months, continues through the summer and is present in autumn and winter. In the late summer and through the winter *P. falciparum* is predominant. *P. malariae* is relatively rare before September or October. The reasons underlying this seasonal prevalence of the different species are only briefly discussed. It is pointed out that *vivax* greatly predominates in the spring in both primary cases and relapses ; that infection with it continues through July and probably later, and that it is easy to infect anophelines in the laboratory with *vivax* in August and September and that sporozoites are formed in abundance. *A. falciparum* has the advantage that an individual harbouring many gametocytes may continue to infect anophelines for three or four weeks in spite of taking quinine.

Older infants were found to be more susceptible to infection than the younger ones. Such insusceptibility of the younger infants is in no sense complete : two infants were found infected after 20 and 24

days of life ; three after 4 to 5 weeks of life and 18 after 6 to 10 weeks. Factors contributing to the lesser prevalence in the early months may be found in the facts that at about six months of age part of the swaddling clothes are removed and the infants are partially weaned, with attendant liability to digestive upset.

Confirmation of the absence of malaria transmission during the winter is furnished by war experience in Macedonia and by the Vlachas. The Vlachas are shepherds who pass the summer in the mountains, the winter in the plains where malaria is endemic. They are free from malaria.

During the past 4 years *A. elutus* has been much the most important, if not the only effective, vector. The sporozoite index of *elutus* is highest in August, but infected anophelines may be relatively numerous even in winter. Laboratory experiments have shown, however, that the rate of oöcyst development is low in October and November and probably throughout the winter : nearly three-quarters of the sporozoites in winter are wholly or partially degenerated. The transmission of malaria does not run parallel with the sporozoite index but it is intimately related to the density of *elutus* and its biting activities. Lessened biting activity is shown by large fat deposits and decrease in the number of anophelines with well matured eggs. Biting activity was also studied directly by means of the precipitin test. Temperature and the density and biting activities of mosquitoes are considered the most important factors in the transmission of malaria and these factors are most favourable for such transmission about midsummer. *N. W.*

Rankov (M.). Ueber die Malariakurven am Balkan. [**Malaria Curves in the Balkans.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1936. Sept. Vol. 40. No. 9. pp. 373–381. With 7 figs. [43 refs.]

A study of 75,480 cases of malaria in eight malaria stations in South Serbia during the period 1928 to 1932.

In all cases the diagnosis was confirmed by microscopic examination. The yearly course of malaria was charted by means of curves, both for each variety, and for the combination of all varieties. From an investigation of post-war conditions amongst colonists and troops it was demonstrated that the spring epidemic of malaria was due to relapses, whilst the aestivo-autumnal peak was chiefly produced by infections from new *Anopheles* generations.

In addition to the routine investigations of the malaria stations the yearly course of malaria was studied and graphically recorded from the point of view of the parasitic indices, which were determined monthly during 1928 in 5 villages and 32 schools. *E. D. W. Greig.*

Soviet Union Year Book Press Service. **Decline of Malaria in USSR.** [Mimeographed statement issued 24th September, 1936.]

The following official account of malaria in the U.S.S.R. is of interest in showing the intensive efforts undertaken by the Government to deal with this disease : " According to Professor Sergiyev, head of the Malaria Department of the Commissariat of Health and director of the Central Tropical Institute, during the first six months of 1936 there was a drop of about 35 per cent. in the number of malarial cases and of 40 per cent. in the number of deaths from malaria in U.S.S.R. as compared with the corresponding period of 1935.

"During the first half of 1936 the appropriate bodies of the Commissariat of Health examined 19½ million children. Symptoms of malaria were thus detected early and systematic treatment applied. The Soviet synthetic preparations—plazmotsid and akrykhin—were more widely used than before. These preparations were tested by the international standard test of the Malarial Commission of the League of Nations by the Martsinovsky Tropical Institute.

"In the efforts to wipe out the malaria-carrying mosquito, 2·5 million infested acres were sprinkled with oil, partly by airplanes. Mosquito netting was introduced into the badly infested areas, 200,000 screens being distributed to collective farmers. During the summer 500 groups of doctors and senior medical students joined the fight being carried on by 1,800 permanent malaria organisations. Fifty-thousand collective farmers took part in the oil sprinkling and in the delivery of medicines. The entire forces struggling against malaria were led by 236 malaria specialists, and during the campaign 1,500 doctors and 2,500 assistant doctors working in the villages received special anti-malaria training."

Balteanu (I.), Alexa (I.) & Alexa (E.) with the collaboration of I. Rugina, I. Stretcu, V. Boeru & I. Urzica. Contributions à l'étude de certains problèmes paludéens mis à l'étude par la commission du paludisme de la Société des Nations. (a. La gravité de la maladie d'après le groupe d'âge. b. Lutte antipaludéenne par la méthode du traitement.) [**(a) Malaria in Different Age Groups. (b) Treatment as a Weapon against Malaria.**]—*Arch. Roumaines Path. Expérim. et Microbiol.* Paris. 1935. Dec. Vol. 8. No. 4. pp. 491–519. With 8 figs.

The authors carried out their observations in three villages (Osoi, Costuleni and Macaresti). The proportion of the three types of malaria in these regions is: benign tertian, 52; subtertian, 38; quartan, 6. An immunity to malaria develops with age: up to 15 years about 40 per cent. suffer from attacks of malaria; between 15 and 30 years of age, 15 per cent.; between 30 and 55 years, 10 per cent.; over 55 years, 5 per cent. Most of the relapses occur in children under 15. Attacks in adults are less severe and terminate in a few days after a little treatment, or even without it, but, in children, the attacks are severe. *W. F.*

Dunn (C. L.). **Malaria in Ceylon: an Enquiry into its Causes. The Therapeutic and Other Measures used during the Epidemic of 1934–35, with Recommendations for the Prevention of Future Epidemics.** pp. vi + 57. With 4 maps & 4 graphs. [36 refs.] 1936. London: Baillière, Tindall & Cox, 7 & 8 Henrietta Street, Covent Garden, W.C.2. [6*s*.]

This report, well printed and produced, contains the results of an inquiry carried out by Colonel Dunn during a two months' stay in Ceylon at the close of 1935. It is based largely on official reports.

Deficient rainfall caused insufficient flushing of streams and rivers and the breeding places of *A. culicifacies* were thereby greatly increased. This fact in the presence of a sufficient number of gamete carriers among an unusually susceptible population, due to four years of low malaria prevalence, is, in the opinion of the author, sufficient to explain the genesis of the serious epidemic.

The therapeutics of malaria occupies an important part of the report. Most of the author's findings and recommendations with regard to this were published in the *Transactions of the Royal Society of Tropical Medicine and Hygiene*, July 1936 [this *Bulletin*, 1937, Vol. 34, p. 63]. Briefly the author considers quinine the only safe remedy for the mass treatment of malaria: quinine combined with plasmoquine, in non-toxic doses for short periods, is, however, recommended " with a view to reducing the relapse rate and attacking the sexual phase of the parasite of malignant tertian fever when present." [Much, perhaps undue, emphasis is laid on the toxicity of atebrin. Many with a large experience of atebrin in the treatment of malaria would be unwilling to subscribe to all the author says regarding the dangers attendant upon its use.]

N. W.

DAUER (C. C.) & FAUST (Ernest Carroll). **Malaria Mortality in the Southern United States for 1934 with Supplementary Data for Previous Years.**—*Southern Med. Jl.* 1936. July. Vol. 29. No. 7. pp. 757–764. With 5 figs.

This report is based on the official returns received from State Health Departments giving the number of deaths attributed to malaria in each county. A map is produced showing the distribution of malaria mortality for the five-year period 1929–33, from which it appears that there are two major and one minor endemic areas. The eastern major area includes parts of South Carolina, Georgia, Florida and Alabama. The western major area includes the south-east part of Missouri, the extreme western parts of Tennessee and Kentucky, the eastern half of Arkansas, the delta counties of Mississippi and north Louisiana. The minor endemic area includes a few counties in the south-west of Oklahoma, north-east Texas and south-west Arkansas. The average malaria mortality rate per 100,000 for the eastern area for the five-year period was 38·2, and for 1934, 50·7. Corresponding figures for the western area are 26·8 and 41·2. A graph showing annual mortality figures in the Southern States exhibits similar cyclic waves in both major endemic areas, but the peak years are a year earlier in the western than in the eastern area. This is a constant phenomenon for which no explanation is forthcoming.

The age distribution of malaria deaths in three States, for the coloured and white populations separately, is shown in a graph. As one would expect the mortality rates are high in the age group 0–4. The very high malaria mortality rates in the highest age groups are more unexpected and raise a suspicion of inaccuracies in the registration of causes of death, such as occur in many countries in which malaria is an important cause of sickness. This possibility is referred to by the author.

There has been no apparent decrease in malaria mortality during the last ten years in the Southern United States. *N. W.*

GENKA (C.). Statistik der Malariamilztumoren in Formosa nebst ein Beitrag zur gasumsätzlichen Studien der chronischen Malaria. [**Malarial Splenomegaly in Formosa with a Note on Metabolic Exchanges.**]—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. June. Vol. 35. No. 6 (375). [In Japanese. pp. 1251–1267. [20 refs.] German summary p. 1267.]

Malarial splenomegaly is common in Formosa; in many cases parasites are no longer found. In 1930 splenic enlargement was observed in 16·1 per cent. of the inhabitants; it is commonest in association with benign tertian infection 24·5–52 per cent., with subtertian 25–37 and with quartan 11–23·6 per cent. Great enlargement occurred among those under 10 years (25·3 per cent.) and in those in their third decade (20·6). Among the indigenous the rate was very high, 68 per cent., among Japanese only 2 per cent., and among other Formosan inhabitants 29 per cent.

In chronic malaria subjects the basal exchange was raised, the respiratory quotient reduced, as was also the blood CO_2. *H. H. S.*

SERRA (G.). Contribution à l'étude du paludisme chez les enfants noirs.—*Bull. Méd. du Katanga.* 1936. Vol. 13. No. 1. pp. 1, 3–9, 11–12.

MANSON (D.). **Velocity, Silt and Larval Drift.**—*Indian Med. Gaz.* 1936. May. Vol. 71. No. 5. pp. 270–275. With 3 charts.

The Assam Malaria Research Officer had advised that anti-larval control should be continued during the first half of the year only. The author considers that this advice is bad because there are multitudes of larvae along the banks of the rivers outside the areas of control which are carried down stream into the protected zones. Another objection which he raises is that adult *Anopheles* would invade these zones by migrating from unprotected areas. He concludes that the danger of such a scheme cannot be estimated. He instances estates where all water-courses are completely dried up in the dry weather and where no breeding places can be found for miles, yet there is intense malaria in the rainy season. This malaria is due to the larvae being carried in by water from outside. He draws attention to the difficulty of dealing with the rapid rivers of Assam; " the present method of control is to oil *A. minimus* areas in permanent water in bamboo enclosures along the banks." " Velocities which exceed the average of 2·04 miles per hour . . . are inimical to larval life in Assam." *W. F.*

SCHARFF (J. W.). **Anti-Malarial Drainage from the Point of View of the Health Officer. Parts III & IV.**—*Malayan Med. Jl.* 1936. Mar. & June. Vol. 11. Nos. 1 & 2. pp. 40–52; 67–90. With figs. 16–29, 2 plans & 3 diagrams. [30 refs.]

These papers contain a vast amount of information on the subject of anti-malarial drainage, based, evidently, on a wide knowledge and experience of conditions in Malaya. Though there is little that is new, workers in this field might profit from a careful study of these papers. Technical details are admirably described and illustrated. The last paper concludes with a short dissertation on malaria control in general.

N. W.

Wanson (M.). Note sur un poisson culiciphage du Bas-Congo. [**A Larva-eating Fish of the Lower Congo.**]—*Ann. Soc. Belge de Méd. Trop.* 1936. Mar. 31. Vol. 16. No. 1. pp. 153–158. With 1 fig.

The author observed that certain pools on the sandy peninsula of Banana, at the mouth of the Congo, contained no mosquito larvae whereas, in other pools, they were present in great numbers. He found that the pools without larvae were connected with the creek at high tide, and that they were full of a larva-eating fish which had gained access in this way. The fish was identified as *Tilapia hendeloti*, and in the illustration given it looks something like a small perch. When introduced into other pools it increased rapidly. The young fish feed on larvae, the older specimens do not. They live, normally, in water with a salinity of 15 parts per thousand, but will flourish in much higher concentrations. They are destroyed by a concentration of 38 parts per thousand. *W. F.*

Mulder (J. G. A.). De malariabestrijding te Tjalang, Westkust van Atjeh. [**The Campaign against Malaria in Tjalang on the West Coast of Atjeh.**]—*Geneesk. Tijdschr. v. Nederl.- Indië.* 1936. July 28. Vol. 76. No. 30. pp. 1864–1889. With 8 figs. on 3 plates, 1 map & 5 figs.

The story which is unfolded in this article is one of intelligent application of measures that have only been adopted after a careful study of the local conditions. These relate to the carrier mosquito, the influence of heavy sea breakers, the effect of downpour in contradistinction to quiet rainfall and the formation of sand dunes as an obstruction to the drainage of lagoons and swamps. Tjalang is a military cantonment on the west coast at the northern extremity of Sumatra. It had acquired great notoriety as a malarial region and this was duly reported every year with a variety of explanation of the cause and consequent remedy. The withdrawal of the military garrison was even at one time suggested. In the course of one single year, however, the remedy seems to have been discovered and applied : the result has been that up to the end of March, 1936, Tjalang has, practically speaking, been free from malaria, while the cost of the measures taken has been low. The cantonment of Tjalang, 1 to 3 metres above sea level, is in somewhat close proximity to lagoons and swamps which contain, owing to the occasional incursion of the sea, brackish water. These lagoons are fed by streams from the hill range which is found along the entire length of the west coast of Sumatra. The region is not one of mangrove growth, but the lagoon and swamp areas, which have been drained by earth channels, were liable to have these channels silted up by the formation of sand dunes. Heavy rain, when it occurred, would result in a break through to the sea and a clean up of the area. Malarial incidence then showed a fall. Heavy breakers from the sea at some seasons of the year counteracted the effects of heavy rainfall and also supplied a brackish water in which *A. ludlowi* bred abundantly. This malaria-carrying mosquito was the cause of all the trouble. Attempts at drainage of lagoons had previously failed owing to want of appreciation of the necessity that the mouths of the drains had to be kept permanently open. This

was effected by altering their course so as to pass through rocky beach. Drains were also constructed of tree trunks and of cement. It is proposed that ultimately they shall be of iron and cement.

The general principle adopted, of which the details are set out in full, was to *drain first* before attempting to fill in swamps or raise levels. Whole areas have been rendered dry by what have been essentially drainage measures, although other methods such as the erection of dams have also been employed. It may now be said that endemic malaria has disappeared from Tjalang and it is suggested that what has been done for one place on the west coast of Sumatra can probably be done for others which are similarly placed. Excellent graphs, photographs, a map and tables are included in the text.

W. F. Harvey.

Tenorio Nieto (Alfonso). Notas sobre profilaxia anti-malarica en la mina "Asnazu." [**Antimalaria Measures in a Mining Community, Asnazu, Colombia.**]—*Rev. Méd. de Bogotá.* 1936. Jan.–Feb. Vol. 45. Nos. 533–534. pp. 201–221. With 7 figs.

A description of the measures taken to protect the personnel, numbering about 200, of the Asnazu Gold Dredging Co., Ltd., who work in an intensely malarious part of Colombia, and of the success attained. The vectors are *A. argyritarsis* and *A. pseudo-punctipennis*. The reduction in morbidity is in large measure attributed to the use of synthetic drugs.

N. W.

Miyahara (Hatsuo). **Clinical Studies on Malaria. I. On the Chloride Content of Blood.**—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. May. Vol. 35. No. 5 (374). [In Japanese pp. 1092–1127. [58 refs.] English summary p. 1127.]

"It is an established fact that when the CO_2 tension is increased, the chloride content of the blood plasma is reduced, being transferred to within the erythrocytes, and the sodium ions left free in the plasma are combined with CO_2—the so-called Hamburger's phenomenon. The clinical symptoms in malaria point to the presence of acidosis, and accordingly the author undertook an examination of the blood chlorides in 106 cases of malaria. Employing Rusznyak's method of chloride estimation, the presence of Hamburger's phenomenon was noted during the paroxysmal stage, which was apparent also in the intervals, for the plasma chloride during the fever-free periods was less than in the recovered stage (i.e., ascertained as recovered by the 8-weeks-after-observation) while the chloride content of the erythrocytes was greater. Here it may be noted that the chloride content in the fever-free intervals though maintaining almost the normal figure is decidedly less than in the recovered stage. Thus, in malaria it is apparent that two factors are present, one tending to lower (acidosis ?) and the other (unknown factor) tending to increase the plasma chloride. In Taihoku the chloride content of both the blood plasma and of whole blood in the healthy male adult is lower than the figures reported for other temperate regions."

MIYAHARA (Hatsuo). **Clinical Studies on Malaria. IV. On the Pulse-Rate and the Blood-Pressure.**—*Taiwan Igakkai Zasshi (Jl. Med. Assoc. Formosa).* 1936. Oct. Vol. 35. No. 10 (379). [In Japanese pp. 2255–2271. [64 refs.] English summary p. 2272.]

The pulse rate of the normal adult Chinese male in Formosa is the same as in temperate climates. During the acute stage of malaria the pulse rate was found to increase but not corresponding to the rise in temperature, possibly owing to the malaria toxin stimulating the vagus (the author suggests). After treatment, when the patient is apparently cured, some 8 weeks after the attack, the pulse remains at a higher rate than normal, owing, in part at least, to malarial anaemia.

The blood pressure [no figures are given] is, in summer, lower than in temperate zones. During the malaria paroxysm, the systolic pressure rises with rise of temperature and later falls, the first due perhaps to stimulation of the sympathetic, the second to the vagus. During the subsequent afebrile period the pressure is below normal owing, it is thought, to irritation of the vagus, together with cardiac weakness ; after cure the systolic pressure returns to normal, but the diastolic remains low. *H. H. S.*

TURNER (Carrol C.). **The Neurologic and Psychiatric Manifestations of Malaria.**—*Southern Med. Jl.* 1936. June. Vol. 29. No. 6. pp. 578–585. [23 refs.]

The author states that he has had personal experience of several cases of atebrin psychosis. " The earliest symptoms are mental exhilaration and insomnia, which yield only to the most drastic sedatives. This is soon followed by . . . unrest and continuous and uncontrollable verbosity . . . . Agitation progresses until the patient is walking the floor almost shrieking in a peak of verbal flow. The language is coherent and is usually an elaboration of some experience of the preceding few hours or days, . . . the patient lashes out at the nearest object or at those who attempt restraint. This condition gradually merges into a somnolent delirium . . . . As the patient regains consciousness, mental confusion is manifest with complete disorientation . . . . This period may clear up readily in a few days, but may become chronic . . . ." *W. F.*

PONDÉ (Adriano). Disturbi mentali nella malaria. [**Mental Derangement in Malaria.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 4. pp. 302–306. French summary (8 lines).

Description of a case of a half-caste in Brazil suffering from dementia (amenza attonita), in whose blood were parasites of *P. falciparum*. Treatment with quinine was followed, after a prolonged stay in hospital, by sudden and complete cure. *N. W.*

TIRUMURTI (Rao Bahadur T. S.) & RAO (P. Ramachandra). **Some Fatal Cases of Malaria. A Morbid Anatomical and Histological Study.**—*Jl. Indian Med. Assoc.* 1936. May. Vol. 5. No. 8. pp. 441–456. With 9 figs. [65 refs.]

The causes of severe symptoms in malaria.

The authors describe the post-mortem findings in 10 acutely fatal cases, and, in the light of these findings, they discuss the causes of the

severe manifestations of malaria. They lay particular stress on the finding, in 4 cases, of " a hyperplasia of the lymphoid tissue in some of the usual sites of aggregation of lymphoid tissue, along with a hypoplasia of the abdominal aorta," and on " the outstanding individual clinical manifestation . . . *viz.*, hyperpnoea (respirations ranging from 32–40 per min.)." They consider that, " the occurrence of anatomical evidences of a lymphoid diathesis, such as preponderance of lymphoid tissue, vascular hypoplasia, persistence of thymus, and adrenal hypertrophy in some of the cases reported in this paper should . . . be regarded . . . as the hallmarks of a diathesis predisposing to hypersensitiveness to the effects of the malarial shock." They write that, " ischaemia due to capillary constriction or occlusion, however, appears to us, to form the morbid anatomical basis of at least some of the serious malarial manifestations " ; and they conclude that, " acute malaria is attended by anaphylactic phenomena, which may cause serious manifestations in sensitized individuals or in those with a lymphoid diathesis, particularly sensitive to shock." *W. F.*

Mageed (Abdel Azim Abdel). A Case of *Plasmodium ovale* in Egypt.—*Jl. Egyptian Med. Assoc.* 1936. May. Vol. 19. No. 5. pp. 229–233. With 4 figs. on 2 plates.

Yao (Y. T.), Ling (L. C.) & Liu (K. B.). **Studies on the So-called Changch'i. I. Changch'i in Kweichow and Kwangsi Border.**—*Chinese Med. Jl.* 1936. May. Vol. 50. No. 5. pp. 726–738. With 4 figs. & 1 map. [10 refs.]

This disease was investigated at the instance of General Chiang Kai Shek, because it had hindered the economical development and military occupation of the province of Kweichow. The disease, Changch'i, is a deadly illness which is supposed to be caused by the inhalation of poisonous gases generated in the valleys by decaying vegetation or the bodies of dead animals. Investigation by the authors showed that Changch'i is subtertian malaria. *W. F.*

Tirumurti (T. S.) & Radhakrishna Rao (M. V.). **The Rôle of Malaria in the Causation of Cirrhosis of the Liver.**—*Indian Jl. Med. Res.* 1936. July. Vol. 24. No. 1. pp. 149–152. With 4 figs. on 2 plates. [12 refs.]

In India malaria is not uncommonly associated with cirrhosis of the liver. In this communication the authors describe the results of the histological examination of a series of " chronic malarial livers." In none of the cases investigated was there any pseudo-lobulation or fibrosis similar to that seen in a typical case of cirrhosis of the liver. Kupffer cells were loaded with malaria pigment. The authors arrive at the conclusion that malaria *per se* is not a direct cause of cirrhosis of the liver. *N. W.*

Davies (J. Rodyn). Unusual or Obscure Case. Benign Tertian Malaria associated with Urticaria.—*East African Med. Jl.* 1936. Aug. Vol. 13. No. 5. pp. 146–147.

Ganguli (P.) & Bhattacharya (P. B.). A Case of Malaria complicated with Erythematous Rash.—*Indian Med. Gaz.* 1936. Sept. Vol. 71. No. 9. p. 530.

Meyer (Richard). Steinbildung in der Milz nach Malaria als Krankheitsursache. (Bericht ueber einen Fall.)—*Wien. Klin. Woch.* 1936. Dec. 4. Vol. 49. No. 49. pp. 1496–1498. With 4 figs.

Ruge (Heinrich). Zur Frage der James'schen Sporozoitentheorie. [**James's Sporozoite Theory.**]—*Ztschr. f. Hyg. u. Infektionskr.* 1936. Sept. 15. Vol. 118. No. 6. pp. 724–737. With 5 figs.

The author concludes, from his careful observations on 33 patients infected with malarial blood, that he has obtained indirect support for James's views, namely, the penetration of the sporozoites into the reticulo-endothelial tissue, the change of the sporozoites into other forms (merozoites?) and only thereafter they attack the red cells. Further, the hypothesis is supported by the fact that the incubation period of benign tertian malaria is uninfluenced by an increase of the number of parasites introduced. Also in two cases, in which the reticulo-endothelial system was heavily infected with sporozoites, numerous relapses occurred in spite of complete treatment on the usual lines, even although the dose of the drug was considerably increased at the first relapse. Also the results of treatment with the new drugs, atebrin and plasmoquine, support the sporozoite theory, and indicate that both these drugs have a sporozoiticidal action.

E. D. W. Greig.

Jolly (A. M. D.). Aspects atypiques du *Plasmodium falciparum* chez les enfants indigènes en bas âge à Brazzaville (A.E.F.). Fréquence de l'évolution schizogonique et gamétogonique complète dans le sang périphérique. [**Frequency of all Developmental Forms of Schizonts and Gametocytes of *Plasmodium falciparum* in the Circulating Blood of Young Native Children in Brazzaville.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 4. pp. 229–239. With 1 chart & 1 plate.

In Brazzaville one frequently sees young native children (below the age of 4 to 5 years) suffering from malaria in whose blood all developmental forms of schizonts and gametocytes of *P. falciparum* can be found. Such a phenomenon is never seen in older children or native adults, who have for the most part developed a high degree of tolerance. It is never seen in European children, who have almost always been treated with quinine. These unusual cases are very severe and, if untreated, are attended with a considerable mortality. Many of them have a degree of splenic enlargement that is unusual in malignant tertian infections. Parasites are very numerous during the febrile attack and relatively numerous during periods of apyrexia, as are large mononuclear cells containing melanin. All this indicates a very low degree of resistance. All these cases were observed during the hyperendemic season, October to mid-December, which is synchronous with the beginning of the rainy season.

The forms of parasite seen are described in detail and well illustrated. The red cells were uniformly normal in size and shape: there were no Schüffner's dots. The typical fine ring forms, without pigment, were characteristic. Numerous amoeboid forms were seen, including all stages up to the formation of gametocytes. Certain of these forms might on superficial examination be mistaken for *P. malariae.* Rosettes

with many merozoites, generally as many as 30, irregularly placed, were noted, with variable arrangement of pigment. Intraglobular forms of gametocytes were often found, including unusual developing forms, which the author names "plastic gametocytes." In short, all developing forms such as may be found in culture by Bass's method were found in the peripheral blood. The conditions in which crescents develop and their morphology gives one to believe that they are true resistant forms of the parasite : they replace plastic gametocytes when conditions for the parasite become unfavourable, owing to increased resistance of the host or drug treatment for example.

These unusual forms of malaria, and the abnormal forms of parasite which characterize them, are remarkably amenable to treatment with quinine; in subsequent febrile attacks only the usual ring forms and crescents are found. *N. W.*

DE MEILLON (Botha). **Nuclear Division in Sporozoites of *Plasmodium*.**—*South African Med. Jl.* 1936. July 11. Vol. 10. No. 13. p. 474. With 1 fig.

Routine dissection of mosquitoes is done by the author in distilled water. This causes the sporozoites to swell up and thus become more readily identified. Not all sporozoites behave in this manner. Unswollen sporozoites in an *A. funestus* were seen to contain several chromatin masses throughout their length except at the extreme ends. Nuclear division in sporozoites has previously been observed by KNOWLES and BASU, and by MISSIROLI. de Meillon suggests that such nuclear division may be necessary for successful infection of the human host. *N. W.*

BARBER (M. A.). **Degeneration of Sporozoites of the Malaria Parasite in Anopheline Mosquitoes in Nature and its Relation to the Transmission of Malaria.**—*Amer. Jl. Hyg.* 1936. July. Vol. 24. No. 1. pp. 45–56. With 1 plate.

Degeneration of sporozoites in the salivary glands has been frequently observed in anophelines infected in the laboratory but much less frequently in naturally infected mosquitoes. Particular interest attaches therefore to this report describing observations in Greek Macedonia and in Cyprus, where this phenomenon is remarkably common. All degrees of degeneration were noted, but for purposes of description the author has classified sporozoites as "(*a*) normal, (*b*) abnormally thickened, and (*c*) wholly degenerate or with a considerable proportion of degenerate sporozoites intermingled."

During the last four years 515 sporozoite positive anophelines have been found in Macedonia : 343 *elutus*, 164 *superpictus* and 8 *maculipennis*. The frequency of sporozoite degeneration is shown in Table I which is reproduced :—

Species	Number examined	Percent. with normal sporozoites	Percent. with thickened sporozoites	Percent. with degenerate sporozoites
Elutus ...	343	45·8	20·4	33·8
Superpictus ...	164	14·6	43·3	42·1

Degeneration of *elutus* sporozoites was much less common in summer and autumn than in winter. In *superpictus*, however, only 9·5 per cent. of 105 dissected during the summer months had normal sporozoites.

In Cyprus, in July, of 72 infected *superpictus* 11 per cent. had normal sporozoites: in 57 per cent. sporozoites were thickened and in 32 per cent. they were degenerated.

In a series of laboratory experiments it was found that degeneration may occur among quite young sporozoites, at summer temperature; such degeneration was found with *P. vivax* in *superpictus* and *maculipennis*, and with *P. falciparum* in *superpictus*, *maculipennis* and *elutus*.

A localization of sporozoites of one degree of degeneration was often observed in a salivary gland or in a lobe of a gland. In the other gland, or in another lobe, sporozoites either normal or in a different stage of degeneration might be found.

Epidemiological studies in Macedonia and in Cyprus have led the author to believe that degeneration of sporozoites may help to explain the relative inability of *superpictus* to transmit malaria; this relative inability is especially marked in Macedonia. *N. W.*

Sobky (M.). **Effect of Anti-Malaria Drugs on Malaria Parasites. (Preliminary Note.)**—*Jl. Egyptian Med. Assoc.* 1936. May. Vol. 19. No. 5. pp. 234–243.

The author counted the parasites in the blood of his patients, gave them a single dose of an antimalaria drug and, after an interval of 3 or 4 hours, he counted the parasites again. On an average there were more parasites after the drug than before. The drugs used were: quinine 5 grains; quinine 10 grains; quinine 15 grains; plasmoquine 0·02 gram; atebrin 0·1 gram. *W. F.*

Barber (M. A.). **The Time Required for the Examination of Thick Blood Films in Malaria Studies, and the Use of Polychromatophilia as an Index of Anemia.**—*Amer. Jl. Hyg.* 1936. July. Vol. 24. No. 1. pp. 25–31.

The author summarizes some of the results of his large experience in routine blood examinations in malaria surveys. It is emphasized that no single examination, however thorough, can do more than reveal a proportion of the parasite carriers. The blood of 65 children was examined on three occasions in November and December when there was no transmission of malaria. A minimum of 66·2 per cent. of these children were infected but in only 36·9 per cent. were parasites found on all three occasions.

For the author the examination of 100 fields of a thick blood film (1/12 oil immersion and 7 × ocular) is sufficient for all practical purposes: this requires approximately two minutes. The importance of having properly prepared blood films is emphasized and a technique for preparing thick and thin films is described.

In dried, unfixed, thick-films, simultaneously stained and dehaemoglobinized in diluted Giemsa stain, abnormal erythrocytes are distinguishable as blue clouds. The degree of polychromatophilia or basophilia thus revealed is used by the author as a rough measure of anaemia. Four grades are distinguished according to the number of

clouds per thick-film field. Such a measure is found to accord remarkably with the degree of anaemia as revealed by the Dare haemoglobinometer. The spleen index tends to lag when the parasite index rises or falls ; the microscopic anaemia index is more sensitive to such changes, and should be a useful adjunct to malaria surveys. *N. W.*

WRIGHT (H. B.). **Notes on Henry's Melano-Flocculation Test as an Aid to the Early Diagnosis of Malaria.**—*Jl. Roy. Army Med. Corps.* 1936. Oct. Vol. 67. No. 4. pp. 264–266.

The author concludes that, though Henry's reaction is not very often positive in the early stages of malaria, the consistently negative results obtained in non-malarial fevers makes it well worth carrying out in early cases of fever in which no parasites can be found. *N. W.*

HENRY (A.). Mélanofloculation et expertise des pensionnés.—*Bull. Soc. Path. Exot.* 1936. May 13. Vol. 29. No. 5. pp. 493–496.

CIUCA (M.), BALLIF (L.), CHELARESCU (M.) & LAVRINENKO (M.). Contributions à l'étude de l'action dévitalisante d'une dose unique de plasmoquine de 0,02 ctgr. sur les gamétocytes de la tierce maligne. [**The Devitalizing Effect of a Single Dose of 0·02 Gram of Plasmoquine upon the Gametocytes of Subtertian Malaria.**] —*Arch. Roumaines Path. Expérim. et Microbiol.* Paris. 1935. Dec. Vol. 8. No. 4. pp. 471–489.

This dose is effective within 48 hours in most cases, but not in all, and, in practice, the dose should be given twice weekly.

Twenty-six cases, comprising 14 of natural infection, 5 experimentally infected by mosquitoes, and 7 cases of blood-inoculated infection were given a single dose of 0·02 gm. plasmoquine. The gametocytes were counted, the number of exflagellations was counted (following the technique of James and Schute) and mosquitoes were fed on the patients. These procedures were carried out 4 hours before inoculation with plasmoquine, 4 hours after, and daily thereafter for 15 days. Dissections of mosquitoes were made from the 3rd to the 10th day after feeding.

The results were as follows :—The blood of all patients was still infective for mosquitoes 4 hours after the administration of 0·02 gram plasmoquine. After 24 hours, 12 cases infected mosquitoes. After 48 hours, 4 cases. After the 3rd day only one case remained infective. The number of gametocytes increased during the first 24 hours after the administration of the plasmoquine and then decreased. In 15 of the 26 cases gametocytes were present up to the 9th day. In 12 cases there were as many as 40 or 50 exflagellating gametocytes per cubic millimetre, although the blood was no longer infective for mosquitoes. The authors conclude that 0·02 gram plasmoquine exerts a gametocidal effect in most cases within 48 hours, but in the field it is best to give a dose twice a week. *W. F.*

DIKSHIT (B. B.). **Pharmacological Action of Plasmoquine.**—*Records of the Malaria Survey of India.* 1936. Sept. Vol. 6. No. 3. pp. 453–466. With 5 figs. & 1 graph. [14 refs.]

" (1) Tests on protozoa and bacteria show that plasmoquine is not very toxic to these. Toxicity tests were also made in cats, dogs, rabbits, guinea-pigs and leeches.

" (2) Plasmoquine has no antipyretic action of its own. In combination with quinine, however, it produces a quicker action than quinine alone.

" (3) Plasmoquine reduces the blood pressure by acting directly on the heart and also by its action on the vasomotor centre.

" (4) It depresses the respiration and constricts the bronchioles to a slight degree.

" (5) The movements of the gastro-intestinal tract are inhibited. Plasmoquine produces a fatty degeneration of the liver cells when given in toxic doses.

" (6) There is evidence of general depression of the central nervous system and a moderate stimulant action on the uterus."

MIETZSCH (F.), MAUSS (H.) & HECHT (G.). **Experimental Studies on Atebrin.**—*Indian Med. Gaz.* 1936. Sept. Vol. 71. No. 9. pp. 521–524. With 2 curves.

Atebrin in watery solution decomposes by hydrolysis ; this process is accelerated by heat. The aliphatic component remains in solution. The cyclical component, 2-methoxy-6-chloracridone, is precipitated as a light yellow crystalline powder. Neither of these two end products is as toxic as atebrin itself, but it is advisable to inject watery solutions of atebrin as soon as possible after they have been prepared. By mouth watery solutions should not be given later than 12 hours after their preparation : the full degree of their activity cannot be depended on if kept longer than this. *N. W.*

HECHT (Gerhard). Die Verteilung des Atebrins im Organismus. [**Distribution of Atebrin in the Body.**]—*Arch. f. Experim. Path. u. Pharm.* 1936. Oct. 20. Vol. 183. No. 1. pp. 87–105. [12 refs.]

The author considers that the unsatisfactory state of our knowledge of the distribution of atebrin in the body is due to the want of a method for its quantitative estimation in the organs. He tried the method of CHOPRA and ROY (this *Bulletin*, 1936, Vol. 33, p. 273) but had to abandon it as it did not enable him to recover quantitatively from the blood of various animals the added atebrin. So he elaborated his own method, which he describes. Using his method he found that the liver, lungs, kidneys and spleen in this order took up the atebrin strongly, then follow the stomach and intestines, heart, pancreas and genital organs. The muscles, skin and central nervous system take it up very slightly. Atebrin is taken up by the organs which it meets first, thus in the case of intravenous administration the lungs, but the liver in oral administration. The lungs retain the atebrin longest. Atebrin passes rapidly from the blood into the organs. In intramuscular administration the level of atebrin in the blood after an hour can be quite definitely determined, whilst in oral administration the level is barely determinable then. All the experimental work was done in animals, rabbits and cats.

He states that KEHAR (this *Bulletin*, 1936, Vol. 33, p. 796), who wrote to him regarding a much over-stretched theory of the circulation of atebrin by the liver-bile-intestine-liver, is obviously not familiar with his work. He emphasizes that he has recorded exclusively experimental findings. *E. D. W. Greig.*

SEELIG (S. F.) & SINGH (Wadhawa). **A Clinical Study of the Effects of treating Malaria with Atebrin and Atebrin Musonate.**—*Records of the Malaria Survey of India.* 1936. June. Vol. 6 No. 2. pp. 171–175. With 25 charts.

This is an account of the treatment of 25 Sikh soldiers suffering from malaria, of whom 11 were infected with *P. vivax*, 13 with *P. falciparum* and one with *P. malariae*. Eight of them received a subcutaneous injection of 0·75 mgm. adrenaline followed half an hour later by an intramuscular injection of 0·375 gm. atebrin musonate. Twenty-four hours later a five-day course of atebrin tablets was commenced, 0·1 gm. three times a day.

There was no fever after the commencement of treatment and the parasites disappeared.

Seven cases received the adrenaline and atebrin musonate injections as above but no subsequent treatment. Fever returned and parasites persisted in five of these cases.

Eight patients received each two intramuscular injections of atebrin musonate, 0·375 gm., at an interval of 24 hours. In one case only did the fever return and the parasites persist.

Temperature charts and treatment notes of each patient are reproduced. The authors conclude that the combined atebrin musonate and atebrin treatment, as carried out with the first group of patients, is the best for the rapid restoration of fitness for military duty of the patients under their charge. *N. W.*

VAN HEUKELOM (A. Siegenbeek) & OVERBEEK (J. G.). Behandeling van de acute malaria-aanval met atebrine pro injectione. [**Treatment of Acute Malaria with Atebrin Injections.**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1936. Oct. 6. Vol. 76. No. 40. pp. 2507–2529. With 1 fig. & 2 charts. [31 refs.] English summary.

During the nine months, August 1935–May 1936, 119 cases of acute malaria were treated by intramuscular injections of atebrin. One hundred of these, 62 subtertian, 16 benign tertian, 5 quartan and 17 mixed infections, are compared with a similar series treated at the same hospital with quinine given orally in the usual way. Those receiving the atebrin (in doses of 0·3 gm.) lost the fever in 48 hours in 87 per cent., those given quinine in 77 per cent. With so few cases the difference has no statistical significance. No cases of poisoning were observed; two patients had epileptiform attacks and both died, but at autopsy cerebral disease was found to account for this. Yellow discoloration of the skin was seen on two occasions. The atebrin had no effect on gametocytes of *P. falciparum*. A satisfactory follow-up treatment is yet to be determined; the atebrin, 2 doses of 0·3 gm. intramuscularly, did not prevent relapses. *H. H. S.*

BERCOVITZ (Nathaniel). **The Use of Atebrin-Musonat for Malaria in Hainan, China.**—*Chinese Med. Jl.* 1936. May. Vol. 50. No. 5. pp. 687–692.

Details are given of 25 cases treated with two injections of atebrin musonate (each of 0·3 gram), subcutaneously or intramuscularly, with a 24-hour interval between them. Some of the patients were very ill with malaria, three were pregnant, two were children 8 and 12 years old,

none was younger. No toxic symptoms followed the injections. The therapeutic results were excellent. " The use of quinine with plasmoquine following the 2 injections of Atebrin-Musonat does much to bring back the general tone of the patient, as well as taking care of any stray parasites not killed by the injections." *W. F.*

Kang (T.) & Garvis (B. W.). **Maniacal Symptoms following Use of Atebrin. Report of a Case.**—*Chinese Med. Jl.* 1936. July. Vol. 50. No. 7. pp. 976–978.

A young intelligent adult male, with no personal or family history of mental or nervous trouble, developed maniacal symptoms two days after the completion of a five-day course of treatment with atebrin. The total amount of atebrin taken was 1·5 grams. The symptoms lasted about eight days. *N. W.*

Ejercito (Antonio). Present Concept of the Therapeusis of Malaria.—*Jl. Philippine Islands Med. Assoc.* 1936. Apr. Vol. 16. No. 4. pp. 207–220. [32 refs.]

Bhattacharyya (Rasamay). Observations on the Relative Value of Atebrin and Quinine as Therapeutic Agents in Malaria.—*Indian Med. Gaz.* 1936. July. Vol. 71. No. 7. pp. 375–376.

Flack (Hugh), Majumder (D. C.) & Goldsmith (K.). Atebrin by Injection *vs.* Quinine in a Tea-Garden Practice.—*Indian Med. Gaz.* 1936. July. Vol. 71. No. 7. pp. 373–375.

Naegelsbach (E.). **Solvochin for Intravenous and Intramuscular Injection in Malaria.**—*South African Med. Jl.* 1936. June 13. Vol. 10. No. 11. p. 408.

The author calls attention to the value of Solvochin in the treatment of malaria whenever intramuscular or intravenous medication is indicated; his recommendation is based on eight years' experience. Solvochin is said to contain quinine in weakly alkaline solution. Intramuscular injections are free from the pain which the usually employed quinine preparations commonly cause. For intramuscular injections one ampoule is given twice a day ; this is equivalent to a daily dose of 15 grains of quinine hydrochloride. For children a diminished dose is given, according to weight. For intravenous injection one ampoule is diluted with 6 to 8 cc. of boiled water. [Solvochin is manufactured by the Chemisch-Pharmazeutische Aktien-Gessellschaft, Bad Homburg.] *N. W.*

Mezincesco (D.) & Cornelson (D. A.) with the collaboration of C. Lazar & L. Buşilă. Sur l'efficacité de l'atébrine et de la quinine dans le traitement prophylactique du paludisme. [**The Prophylactic Treatment of Malaria with Atebrin and with Quinine.**] —*Arch. Roumaines Path. Expérim. et Microbiol.* Paris. 1935. Dec. Vol. 8. No. 4. pp. 449–470. With 3 maps, 1 fig. & 1 graph.

The drugs acted equally well, but there were many relapses in the spring. Skin staining is a disadvantage in atebrin prophylaxis.

Half the inhabitants (132) of a Rumanian village received prophylactic treatment with atebrin and the other half with quinine. This

treatment was begun at the beginning of the malaria season in July, and was continued until the beginning of December. All those who were found with parasites in their blood at the beginning of the prophylactic treatment, or at the monthly blood examination, were given a course of curative treatment. A month after the beginning of the experiment, there were very few parasite carriers in either group, and at the beginning of December there were practically none. This freedom from parasites was maintained throughout the winter after the prophylactic treatment had been suspended, but in the spring, the parasitic index rose to 23·1 per cent. in the atebrin group and to 18·5 in the quinine group. The authors concluded that :—(*a*) Atebrin and quinine, in the doses given, were of equal value as prophylactics. (*b*) Eradication could not be effected by these means. (*c*) Transmission occurred during the prophylactic treatment, the infections remaining latent until the following spring. The doses given for prophylactic treatment were :—in one group, atebrin 0·15 gram every other day ; in the other group 0·4 gram quinine daily. The curative treatment consisted, in the atebrin group, of 0·15 gram of atebrin daily for 12 days, with an interval of one day after the sixth day, and, in the quinine group, of 1 gram of quinine daily, for 36 days in 1933 and for 12 days in 1934, with an interval of one day after every sixth day. There were certain drawbacks to the use of atebrin ; by the time 5 doses had been given yellow staining was present in 12 per cent. ; when 14 doses had been given it was present in 82 per cent., and in 6 per cent. it lasted more than 5 months after the suspension of the prophylactic treatment. Vomiting made it necessary to stop treatment in three children under 4 years of age. One adult suffered from severe headache and another from diarrhoea ; atebrin had no bad effect on pregnant women.

W. F.

Rosa (Alberto) & Maccolini (Roberto). Il trattamento preventivo con : Atebrin-Plasmochina nella profilassi della malaria. [**Atebrin-Plasmoquine in the Prevention of Malaria.**]—*Giorn. Ital. di Malat. Esot. e Trop.* 1936. July 31. Vol. 9. No. 7, pp. 133–136.

The investigations described in this paper were designed to determine the value of a combination of atebrin and plasmoquine in the prevention of malaria. The first series of observations relate to ten cases submitted to the bites of infected anophelines, *A. maculipennis* var. *atroparvus*. In seven cases *P. vivax* was employed, in three *P. falciparum*. Treatment, consisting of the administration of one tablet containing atebrin 0·10 gm. and plasmoquine 0·005 gm. twice a day on two successive days in three successive weeks, was sufficient to prevent any febrile attack in persons submitted, within a day or two of the commencement of treatment, to the bites of numerous infected mosquitoes. The patients were kept under observation for periods of from four to seven months.

The second half of the paper deals with a field experiment carried out at Goro with a population of about 2,500. Here malaria is endemic. From the 27th of July to the 27th of November a group of persons were submitted to treatment as follows :—

Age.	*Monday.*	*Wednesday.*	*Saturday.*
4 to 7	atebrin 0·10	plasmoquine 0·01	atebrin 0·10
8 to 15	0·15	0·015	0·15
16 and over	0·20	0·02	0·20

Fifty-seven persons commenced the treatment of whom 36 continued it to the end : only two of these contracted malaria. Taking only the 36 into account the morbidity rate of the group was 5·5 per cent. The malaria morbidity rate of the whole population during the same period amounted to 17·2 per cent. *N. W.*

Earle (Walter C.) & Perez (Manuel). **The Role of Gametocyte Carriers in the Failure of Chemotherapy as a Malaria Control Measure.**—*Bol. Asoc. Med. de Puerto Rico.* 1936. Aug. Vol. 28. No. 8. pp. 167–170.

With the object of explaining some of the difficulties attendant upon attempts to control malaria by treatment of the human carrier a study was made of the conditions under which gametocytes appear in the blood stream. For three years from 30 to 40 children in an endemic centre on the coast of Porto Rico were kept under continuous observation, the malaria parasites being counted once a week, or more frequently when fever was present or when numerous gametocytes were found. The authors conclude that there is no way of predicting the presence of gametocytes in the blood stream. It is obviously impossible to examine blood smears from the general population at frequent intervals to identify carriers. The control of malaria by an attack on the carrier is restricted to groups of people under control, and even here it would probably be necessary to administer a drug to the entire group at regular intervals. *N. W.*

Decourt (Ph.), Marini (Ch.) & Henry (Ch.). Expériences sur la prophylaxie collective du paludisme réalisées à Menzel-Temime (Cap Bon Tunisien) en 1935.—*Bull. Soc. Path. Exot.* 1936. May 13. Vol. 29. No. 5. pp. 480–486.

Wu (L. Y.). **A Study of Anopheline Larvae of Kwangtung Province, with Notes on their Relation to the Incidence of Malaria.**—*Lingnan Sci. Jl.* Continuation of *Lingnaam Agric. Rev.* 1936. Vol. 15. Nos. 1 & 2. pp. 1–10 ; 265–273. With 3 plates & 1 fig. [35 refs.]

The author's summary gives a good account of the contents of this article, the first part of which is purely systematic.

" The present study of anopheline larvae and their relation to the incidence of malaria covers two areas in Kwangtung Province, namely, Swatow and Canton, the field work covering two years, 1931 to 1933. Fragmentary data for 1934 and 1935 are also included.

" An historical review shows that although in the last ten years some work of this kind has been done in North, yet in the South, not including Hong Kong, only fragmentary data have been gathered.

" The following species of anopheline larvae were found during the present study : *A. hyrcanus* var. *sinensis*, *A. tessellatus*, *A. minimus*, *A. maculatus*, *A. jeyporiensis* var. *candidiensis*, and *A. splendidus*. Notes on their breeding habits and a table for the important diagnostic characters of the fourth instar larvae are given. A key to the anopheline larvae reported for Kwantung Province is also given.

" An examination of the relationship between the abundance of the different species of anopheline larvae and environmental factors, such as humidity, temperature, and rainfall, was made. The result of such a correlation was then compared with the incidence of malaria in the localities studied. It was found that rainfall and temperature have great effect

on the abundance of anopheline mosquitoes. *A. minimus* is the natural carrier in the hilly region, while *A. hyrcanus* var. *sinensis* may be responsible for malaria on the plain, and *A. maculatus* appears to be also responsible for malaria in the former. The evidence for *A. tessellatus* as a carrier of malaria is less convincing. For the two remaining species, *A. splendidus* and *A. jeyporiensis* var. *candidiensis*, the present data are too scanty to warrant any definite conclusion." *H. H. S.*

Strickland (C.) & Roy (D. N.). **The Prevalence and Habits of Anophelines in Relation to Physical Conditions. With a Statistical Analysis by** H. P. Chowdhuri.—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 3. pp. 171–186. With 2 charts.

The paper records observations made throughout twelve months in Calcutta. The specimens were caught in selected places at regular intervals; experiments upon the factors which may be supposed to influence the length of life of *Anopheles* were also performed.

In the course of twelve months 8,564 anophelines were taken, 90 per cent. of them being *A. rossi* or *vagus*. Only 273 *A. stephensi*, the species which is presumably responsible for the malaria, were caught during this period. The figures were analysed statistically [perhaps more elaborately than the total numbers warrant]; significant positive correlations were found with rainfall and absolute humidity, for the period four weeks previous to capture. *P. A. Buxton.*

Collignon (E.) & Ambialet (R.). Activité des anophèles et humidité atmosphérique sur le littoral algérien. [**Atmospheric Humidity and Anopheline Activity on the Algerian Coast.**]—*Arch. Inst. Pasteur d'Algérie.* 1936. June. Vol. 14. No. 2. pp. 119–122. With 1 chart.

The observations described were carried out at Taher, situated on raised ground a few miles from the sea on the coast of Algeria. *Anopheles maculipennis* is the preponderating species: estimations of its prevalence were made by means of mosquito traps placed outside the village. In Taher itself captures are negligible, successful anti-larval measures being carried out.

A. maculipennis is most in evidence from May to July. In July there is a rapid diminution in the numbers caught and captures remain insignificant until well on in September. This period of diminished prevalence is characterized by violent fluctuations in the relative atmospheric humidity, occasioned by an alternation of land and sea winds. Temperature remains reasonably constant throughout the period. The authors ascribe the disappearance of anophelines from their usual diurnal resting places to these abrupt falls in the relative humidity. *N. W.*

Lamprell (B. A.). **A Discussion on the Infectivity Surveys and Feeding Habits of Anopheline Mosquitoes in the Oriental Region, with Special Reference to Assam and Northern Bengal.**—*Records of the Malaria Survey of India.* 1936. June. Vol. 6. No. 2. pp. 213–231. [20 refs.]

The subject of this admirable though not readily compressible paper is concisely expressed as " the importance of different species as vectors of malaria in Assam and in other localities in the Oriental region."

As to the factors whereon such " importance " depends, the following enumeration is worth quoting, if only as an example of, and incentive to clear thinking.

" 1. The average gametocyte rate of the community under consideration.

" 2. The density of the carrier species that may be found amongst that community.

" 3. The proportion of each of these species that will bite man at any blood feed and so be liable to ingest gametocytes, or inject sporozoites.

" 4. The proportion in each species of those that bite man in which ingested gametocytes will develop into sporozoites.

" 5. The proportion of those in which sporozoites have developed that will once more feed on man whilst the salivary gland is infected.

" For the practical malariologist *the* factor of ultimate importance is the actual numerical prevalence of mosquitoes with salivary gland infection that at any period are feeding on the blood of the community in which he is trying to apply anti-mosquito methods to control malaria."

Comparison is made between the blood feeding habits of certain anophelines in the tea areas of Assam and Northern Bengal, as determined by workers associated with the Ross Institute of Tropical Hygiene, and similar observations on the same species recorded elsewhere in the Oriental Region. Tables are given showing the " results of 106,272 dissections of anopheline mosquitoes in Assam and Northern Bengal," and these " are compared with the infectivity findings of the Assam Medical Research Society."

Inter alia, the author insists upon the importance of determining the relative density of species in every community, *i.e.* " the relative number of female adults of each species which visits the community under consideration for the purpose of taking a blood meal." Data under this heading combined with others as to salivary gland infection, are furnished in Table IV for nine species of *Anopheles*, as regards four centres in Assam and the whole province. It would appear that " considering Assam as a whole, *A. minimus* is more frequently infected than all other species, and is in great preponderance in Mangaldai." Locally, however, in Assam, *A. minimus* would seem to be replaced by one of the other species, and before estimating the relative importance of each of those mentioned " the androphilic factor must be taken into account." Even *A. philippinensis*, though not yet found in Assam with infected salivary glands, may still, owing to its local abundance, prove to be " a vector of importance in some communities." In order to determine " the ' receptivity index ' of each species to plasmodial infection," there should be " mass experimental feeding of batches of laboratory-hatched mosquitoes on malarious communities." Other matters whereon further research is desirable are " the longevity of species under natural conditions in different areas," and " the average number of blood meals ingested." *E. E. Austen.*

Russell (Paul F.) & Baisas (Francisco E.). **A Practical Illustrated Key to Adults of Philippine Anopheles.**—*Philippine Jl. Sci.* 1936. Jan. Vol. 59. No. 1. pp. 15–64. With 6 figs. & 34 plates (7 coloured). [19 refs.]

Having already (1934) dealt similarly with the *larvae* of Philippine *Anopheles* [see this *Bulletin*, 1935, Vol. 32, p. 803], the authors now

carry their useful labours one stage further, with the proviso that the present key " is subject to revision, as there remains a considerable amount of systematic study to be done, especially on eggs and pupae." As a concession to possible lack of technical skill on the part of " the average field worker," the key so far as possible is based on characters other than male terminalia. It is further explained that in certain cases (*A. insulaeflorum*, *A. baezai*), in default of specimens from typical localities, names are used provisionally.

In addition to the key, detailed descriptions of twenty-five named and two unnamed species are given. The paper is very fully illustrated with original black and white figures of details, while the coloured plates are devoted to *A. minimus* var. *flavirostris* (whole insect), the wings of twenty-seven and the abdomens of five species. *E. E. A.*

Strickland (C.) & Gupta (S. C. Sen.) **The Seasonal Infectivity of Mosquitoes as determined by a Study of the Incidence of Infantile Malaria.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. July 31. Vol. 30. No. 2. pp. 245–250.

If, for any given locality, it is possible to obtain a record of all infants born during the course of a year, with the date of birth of each child and the date of its first attack of malaria, the study of such material is of value in determining seasonal liability to malaria infection. The authors describe the application of this method on a tea estate where all mothers and infants are kept under observation. *N. W.*

Morishita (Kaoru). **On the Anophelines of *aitkeni*-Group in Formosa.**—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. Mar. Vol. 35. No. 3 (372). [In Japanese pp. 583–590. [11 refs.] English summary p. 590.]

A. aitkeni var. *bengalensis*, Puri, and *A. insulaeflorum*, Swellengrebel, have been found in Formosa. They are rare and it is improbable that they are concerned in spreading malaria. *W. F.*

Morishita (Kaoru). Further Notes on the Anopheline Mosquitoes in Formosa.—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. Apr. Vol. 35. No. 4 (373). [In Japanese pp. 888–895. English summary pp. 896–897.]

Puri (I. M.). The Distribution of Anopheline Mosquitoes in India: Additional Records, 1931–1935.—*Records of the Malaria Survey of India.* 1936. June. Vol. 6. No. 2. pp. 177–211. [87 refs.]

Kligler (I. J.) & Mer (G.). Anopheles in Syria and their Distribution.—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 3. pp. 217–221.

Gaschen (H.) & Raynal (J.). Recherches sur les affinités trophiques des anophèles d'Indochine (première note). *Anopheles hyrcanus* **var.** *sinensis*. [**The Feeding Preferences of the Anophelines of Indo-China.**]—*Ann. Inst. Pasteur.* 1936. Sept. Vol. 57. No. 3. pp. 311–324. With 3 graphs.

This is the first instalment of a report on the relationship between the maxillary dentition of the anophelines of northern Indo-China and their anthropophilism or zoophilism as the case may be: it is concerned solely with *A. sinensis*.

In 1933, Roubaud, Toumanoff and Gaschen, studying the *Anopheles* of Tonking, found *sinensis* and *vagus* to be multidentate, and *minimus*, *aconitus*, *jeyporiensis* and *maculatus* paucidentate. The two former play a negligible rôle in the spread of malaria ; the four paucidentate species are all important vectors. Paucidentition and anthropophilism appear to be closely related. The mean maxillary index of 286 *A. sinensis* examined by Roubaud and his colleagues was 15·17. During the investigations under report 1,096 *sinensis* were found to have a mean maxillary index of 15·14. No less than 92 per cent. had an index of 14 or over. Of the total engorged *sinensis* caught in stables and examined 86 per cent. had fed on animal blood ; in houses 69·7 per cent. In the latter case the stomachs of only 8·8 per cent. contained human blood. In a considerable proportion the nature of the blood could not be identified. The nature of the stomach contents was determined by the precipitin test. The zoophilism of *sinensis* in northern Indo-China is thus very marked. This was found to be the case in all places in which the inquiry was carried out, though the animal serving as host varies somewhat from place to place. Sometimes the horse is the important source of food supply, elsewhere pigs. In rural areas, however, cattle, more especially buffaloes, are of chief importance ; where these are numerous the zoophilism of *sinensis* is all but complete. *N. W.*

Hu (Stephen M. K.) & Yu (H.). **Preliminary Studies of the Blood Preferences of *Anopheles hyrcanus* var. *sinensis* Wiedemann in Shanghai Region.**—*Chinese Med. Jl.* 1936. Feb. Supp. No. 1. pp. 379–386. [16 refs.]

The carrier in Shanghai is *A. hyrcanus*. Specimens were caught in a cowshed, starved for 8 days until the blood had disappeared, and then 700 were released into a room which was occupied by a man and a number of animals. On the following morning the mosquitoes were caught and the contents of their stomachs were squeezed out on to filter paper for the precipitin test. The percentage results were as follows :—man 4·8, cow 47·6, goat 25·0, pig 13·8, cat 3·4, dog 3·6, chicken 1·8. *W. F.*

Tagliabue (C.) & Perilli (R.). Ricerche sperimentali sulle diverse razze di *Anopheles maculipennis* e sulle preferenze alimentari degli anofeli in Provincia di Milano. [**Varieties of *A. maculipennis* in the Milan Province and their Feeding Predilections.**]—*Riv. di Malariologia*. Sez. I. 1936. Vol. 15. No. 3. pp. 207–216. [12 refs.] French summary.

The Province of Milan is a region of intense infestation with anophelines but has a low malaria infection rate. The abundance of anophelines is explained by the abundance of irrigated rice fields. Malaria was very widespread at the beginning of the century but at present it is responsible for a morbidity rate of from 5 to 10 per cent. in certain limited areas ; in other areas it is completely absent in spite of the ubiquitous mosquito.

The predominant variety of *A. maculipennis* is *messeae*—70·6 per cent. in the areas with malaria, 92 per cent. in the malaria-free areas. Serum precipitation tests showed that in the malaria-free areas 79·5 per cent. of the anophelines had fed on domestic animals, cattle, pigs or horses,

and only 20·5 per cent. on human beings. In the regions with malaria these figures were 43·6 and 56·4 per cent., respectively. The numbers of domestic animals are considerable :—80 cattle, 31 pigs and 20 horses per square kilometre.

The authors appear to be justified in their conclusion that the predilection of the local anophelines for animal blood may well explain the diminished prevalence of malaria that has characterized recent years.

N. W.

ZOTTA (G.). Races d'*Anopheles maculipennis* en Yougoslavie. (Note préliminaire sur les recherches faites en Yougoslavie pendant l'été de 1934.) [**Races of *Anopheles maculipennis* in Yugoslavia. (Investigations made in Yugoslavia during the Summer of 1934.)**]—*Arch. Roumaines Path. Expérim. et Microbiol.* Paris. 1935. Dec. Vol. 8. No. 4. pp. 427–447. With 1 folding map.

In Yugoslavia the following species are found :—*Anopheles maculipennis, A. elutus, A. pseudopictus, A. superpictus, A. claviger* (*A. bifurcatus*), *A. plumbeus* and *A. algeriensis*. In central and southern Dalmatia, Montenegro and the greater part of Macedonia, *A. superpictus* is the dominant species. It plays a considerable part in the maintenance of endemic malaria, and since it appears later in the season than *A. maculipennis* the disease exhibits a double annual peak. The author's studies of races of *A. maculipennis* were based on egg-characters, and an analysis of 2,498 egg-batches yielded the following results :—*A. m. typicus*, 1,369 ; *A. m. messeae*, 886 ; *A. m. atroparvus*, 1 ; *A. m. labranchiae*, 107 ; *A. elutus*, 135. The numerical distribution of these forms in the different regions studied is shown in a table.

In Croatia, *typicus* and *messeae* are found almost exclusively ; the former breeds especially in running water ; the breeding places of the latter, which is responsible for a prevalent benign type of malaria, are stagnant pools. Dalmatia, considered by the author under three headings, central, northern and southern, exhibits quite different conditions. In the central region, where malaria is locally severe, *A. m. typicus* is the dominant type, though in the interior *labranchiae* (eggs identical with those of this race studied by the author in Italy) was met with for the first time. The races *typicus* and *messeae* were found in northern Dalmatia, where, however, at the beginning of June, *labranchiae* formed 34 per cent. of the total anopheline population, coinciding with malarial endemicity of a very high order. In southern Dalmatia, which includes the valley and mouths of the Neretva river, *A. m. messeae* and *A. elutus* alone were met with, and these again constituted the anopheline fauna of the coastal belt of Montenegro. In Macedonia at the time of the author's visit, the only races observed were *A. m. typicus* and *A. m. messeae* ; although these sometimes occurred together, a pure population of the former was usually found. All centres investigated in this country have a malarial rate between 40 and 90 per cent. ; while the rôle of the two races mentioned is therefore important, that of the later-appearing but very widely distributed *A. superpictus* (*vide supra*) must not be overlooked.

" Remarks concerning various types of eggs " conclude the paper. The eggs of *A. m. labranchiae* found by the author were precisely as described by MISSIROLI, MARTINI, HACKETT *et al.*, as were normally those of *A. m. messeae* and *A. m. typicus* ; but among the eggs of the

two latter, aberrations—connected with the normal type by intermediate gradations—were met with and are duly characterized.

It is noted that, in Dalmatia and the coastal region of Montenegro, kala azar seems to be much more widely distributed than has hitherto been believed, and that close study is needed in order to separate it from malaria, since these two maladies are frequently superimposed.

E. E. A.

Hinman (E. Harold). **Studies upon the Problem of Races of** *Anopheles quadrimaculatus* **Say in the United States.**—*Amer. Jl. Trop. Med.* 1936. May. Vol. 16. No. 3. pp. 303–309. [10 refs.]

Although *A. quadrimaculatus* is the "most important malarial vector" in U.S.A., no attempt has yet been made to discover whether, like its near ally *A. maculipennis*, it is divisible into races or subspecies. Even in the case of *A. maculipennis* itself the racial question so far has not been studied on the North American continent, though the species occurs here and there from Newfoundland to California. The discovery by the author, in late November, of "vast numbers" of hibernating females of *A. quadrimaculatus* in a deserted fort in Southern Louisiana, whereas hibernation *en masse* was not supposed to be a characteristic of this species, led to further observations in the same locality, extending intermittently over four and a half years. As a result, while such local hibernation of *A. quadrimaculatus* was confirmed, no evidence of subspecific or racial difference was afforded by either eggs, larvae or adults. *E. E. A.*

Simmons (James Stevens). *Anopheles* (*Anopheles*) *punctimacula* **Naturally Infected with Malaria Plasmodia.**—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 105–108.

Anopheles punctimacula, which has also been known as *A. strigimacula* and *A. malefactor*, is one of the Arribalzagaia group, and breeds in shaded pools in Panama. According to general belief it is not susceptible to infection. The author reports the examination of a specimen infected with sporozoite-containing zygotes which was caught in a bedroom at Fort Sherman in the Canal Zone. *W. F.*

Simmons (James Stevens). **The Infection of** *Anopheles* (*Anopheles*) *punctimacula* **with Malaria.**—*Rev. Parasit., Clin. y Lab.* Habana. 1936. May–June. Vol. 2. No. 3. pp. 455–460. [11 refs.]

In November 1935 a naturally infected specimen of *Anopheles punctimacula* (syn. *A. malefactor*, *A. strigimacula*) was captured near Limon Bay in the Panama Canal Zone. Subsequent laboratory investigation has shown that this species has a high degree of susceptibility to infection with both *P. vivax* and *P. falciparum*. These observations are of importance as *A. punctimacula* is one of the most prevalent anophelines in the unsanitated areas of the Canal Zone, as it is in many adjacent countries from Mexico to Brazil. (In earlier reports regarding its distribution it may have been confused with *A. neomaculipalpus* (Curry, 1931).)

Hitherto, ever since Darling's unsuccessful attempts at infecting it in 1908, *A. punctimacula* has been regarded as of no importance in so far as the transmission of malaria is concerned. *N. W.*

Barber (M. A.) & Rice (J. B.). **Methods of dissecting and making Permanent Preparations of the Salivary Glands and Stomachs of Anopheles.**—*Amer. Jl. Hyg.* 1936. July. Vol. 24. No. 1. pp. 32–40. With 3 figs.

The method of dissection described is rapid and easy to learn and may be practised without the use of a dissecting microscope. The mosquito is lightly chloroformed. The legs are removed and the head cut off by a clean stroke of a lancet-headed needle. The insect is then laid on its side in a shallow drop of saline. The thorax is steadied with the needle, a small cover-glass (6 by 6 mm.—cut from larger cover-glasses or obtained from dealers) is taken up in a pair of finely pointed curved forceps and sloped on the thorax as shown in a figure. The forceps are then released and the tips placed on the top of the cover-glass. The cover-glass is pressed down gently, while the torso is moved to the left. The effect is to press out the glands and leave them under the cover-glass. The stomach is extracted by holding the thorax with the needle, seizing the tip of the abdomen with the forceps, and slowly drawing out the stomach. The authors also describe a method of making permanent preparations of glands, stomachs, etc., without removal of the cover-glass from the dissections. The paper contains a great many valuable hints that must be read in the original.

V. B. Wigglesworth.

Sicault (G.), Messerlin (A.), Lummau (J.) & Fritz (J.). Le paludisme dans le Rharb. [**Malaria in the Rharb (Morocco).**]—*Bull. Inst. Hyg. Maroc.* Rabat. 1935. No. 1–2. pp. 5–91. With 7 plates. [4 pages of refs.] [Summarized in *Rev. Applied Entom.* Ser. B. 1936. June. Vol. 24. Pt. 6. pp. 123–124.]

"A very detailed account is given of work on malaria and its control in the marshy plain of the Rharb (Morocco) from 1931 to 1934. Since 1933 measures against Anopheline larvae have been undertaken on a large scale. The commonest Anopheline is *Anopheles maculipennis* var. *sicaulti*, Roub. The use of *Gambusia holbrooki* against mosquito larvae has already been described [see this *Bulletin*, 1935, Vol. 32, p. 819.]

"The following is taken from the summary of the section dealing with entomological studies. Among the Anophelines of the Rharb, one or perhaps several anthropophilous races of *A. maculipennis*, Mg., are of importance. The anthropophilism is probably produced by the natural surroundings, since there are scarcely any shelters on the large windy plains except human habitations, wild animals are rare, and flocks live in the open. In the summer, however, the Anophelines are so abundant that they shelter among rushes, cactus, etc. The low density of the population explains the great distances covered by the mosquitos in search of food. Larvae of *A. maculipennis* are found during the winter but are then usually in the third or fourth instars, and oviposition seems to cease in most years between December or January and March or April. During the cold months eggs are only laid in breeding places offering stable conditions of temperature and shelter, and ample nourishment. In the spring, oviposition appears to be influenced by minimum temperature; when this is constant in the neighbourhood of 8°C. [46·4°F.] eggs are found throughout the region. When the maximum winter and spring temperatures are high and the

minimum temperatures vary widely from one week to the next, oviposition occurs throughout the winter, but the number of Anophelines produced is generally moderate. When the winter is cold, rainfall is high, and the minimum temperature remains below 8°C. for some time and then rises suddenly to 10–13°C. [50–55·4°F.], spring oviposition is retarded. Conditions are, however, favourable for development, the larval period is shortened, extensive breeding places have been created by the rains, and a considerable outbreak of Anophelines occurs. The high humidity that seems to be necessary for Anopheline activity prevails throughout the region. When the hot dry south-east winds lower the humidity, Anophelines seek shelter in houses and large numbers die. Violent rain storms destroy most of those sheltering in the open.

" After discussing the epidemiology of the disease, the authors conclude that outbreaks are an indirect result of high rainfall (in a country where malaria is endemic), which, owing largely to the impermeability of the soil, increases the number and extent of breeding places and consequently the abundance of Anophelines.

" The anti-larval work that has been carried out in various localities is outlined. It consisted chiefly of drainage and the application of oil or Paris green. In certain localities the measures were ineffective, partly because the zone treated was not sufficiently wide to prevent the invasion of the Anophelines, which have been found to fly three miles or more."

SICAULT (G.). Note sur l'épandage du vert de Paris per avion au Maroc. [**Distribution of Paris Green from Aeroplanes in Morocco.**] —*Bull. Inst. Hyg. Maroc.* Rabat. 1935. No. 1–2. pp. 93–102. With 2 plates. [Summarized in *Rev. Applied Entom.* Ser. B. 1936. June. Vol. 24. Pt. 6. pp. 124–125.]

" Larvicidal fish cannot be established against Anopheline larvae in large areas of the extensive marshes in the Rharb district of Morocco because they dry up entirely in years when there is little rainfall. Oil cannot be used effectively in many cases because vegetation is abundant. Dusting with Paris green would give control, but at the edges of the marshes the mud is too soft to walk on and the water is too shallow to allow the use of a boat. For these reasons, the experiments described were carried out in 1934 to determine the possibility of dusting by means of aeroplanes.

" Preliminary laboratory experiments with dusts of Paris green and powdered stone in different proportions showed that one with 2 per cent. Paris green was as effective as others with 5, 10, 15 and 20 per cent. The stream of dust was regulated so that when the aeroplane was flown at a height of approximately 50–100 ft. on a still day the amount of dust was about 0·3 oz. per sq. yd. (a rate that is considered to be effective) over an area about 40 yds. wide. Even a slight breeze displaced the dust cloud considerably, and in this case a second journey was made along the edge of the marsh, the line of flight being altered to compensate for the degree of displacement of the dust cloud noted on the first journey. On 5th, 6th and 7th June, dust was applied by aeroplane to marshes that had contained 8 larvae (all instars) per dip ; on 8th and 9th June no pupae and no larvae of the 3rd and 4th instars were found in the treated marshes, although there were a few 2nd instar larvae and quite a number in the 1st instar. The larval density

in untreated marshes remained unchanged. The result was considered satisfactory, but as the average length of the larval period in Morocco is about 15 days, it was decided that dust should be applied at intervals of 10 days. Dusting was carried out in certain localities throughout the summer. In the area for which figures are given, the effectiveness of the treatment is shown by the sudden increase in the numbers of larvae after the dusting ceased. The actual effect on the transmission of malaria was difficult to estimate, particularly as it was not possible to begin dusting until after the emergence of the first generation of Anophelines, and as the populations of a number of villages had been subjected to prophylactic treatment. On the other hand both the native and European residents remarked on the great decrease in the numbers of adult mosquitos ; this was not, however, due entirely to dusting, for in a number of breeding places *Gambusia* had become sufficiently numerous by August for its action to be effective.

" The cost of the dusting is discussed. It is slightly more expensive than oiling and must be carried out at shorter intervals. From August onwards a considerable economy was effected by using a finer mixture (Paris green with an impalpable powder), which dispersed over a wider area and affected 1st and 2nd instar larvae, which are unable to ingest large particles."

SAUTET (Jacques). Contribution à l'étude des culicidae et en particulier de ceux jouant un rôle important dans la transmission du paludisme.—*Rev. Méd. et Hyg. Trop.* 1936. Mar.–Apr. & May–June. Vol. 28. Nos. 2 & 3. pp. 65–96 ; 129–160. With 6 figs.

REUTER (Johannes). **Oriënteerend onderzoek naar de oorzaak van het gedrag van *Anopheles maculipennis* Meigen bij de voedselkeuze.**

This book was reviewed in Vol. 33, p. 415.

SENEVET (G.). Les moustiques de la Martinique.—*Arch. Inst. Pasteur d'Algérie.* 1936. June. Vol. 14. No. 2. pp. 123–134. With 5 figs. [11 refs.]

BARBER (M. A.), RICE (J. B.) & MANDEKOS (A.). **A Dustless Method of diluting and spreading Paris Green in Malaria Control.**—*Amer. Jl. Hyg.* 1936. July. Vol. 24. No. 1. pp. 41–44.

The method described is of great interest and practical importance. It consists in mixing Paris green with kerosene oil. In the dilutions employed the kerosene does not act as a larvicide ; it merely facilitates the spreading of the Paris green and keeps it afloat. The authors carry to the field small containers containing 10 gm. of Paris green in 20 cc. of kerosene. For use this is mixed, on arrival at the place to be treated, with about 250 volumes of water ; this mixture has to be kept agitated during spraying. The spray cloud should have a greenish tint. The results seem to be as good as those obtained with Paris green and road dust. The authors have used a horticulturists' sprayer of 12-quart capacity with a fine spray.

A second ingenious method of using the mixture is as follows. Pebbles, small stones, provided they are not absorbent, or even coarse sand, some or all of which are nearly always available near the breeding place are placed in a pan or basket, wetted and drained. The Paris

green-kerosene mixture, undiluted, is well shaken and poured over the pebbles which are then thrown widely over the breeding place. Where a pebble strikes the water the mixture remains on the surface and spreads. Castor oil, 1 or 0·5 per cent., is usually added to the mixture when thus used, to insure spreading. By this pebble method of application places difficult of access may be treated. It has given good results. *N. W.*

MURRAY (David R. P.). **Mineral Oils as Mosquito Larvicides.**—*Bull. Entom. Res.* 1936. July. Vol. 27. Pt. 2. pp. 289–305.

The work described in this report was carried out in the Department of Entomology of the London School of Hygiene and Tropical Medicine. It contributes interesting and valuable information as to the manner in which mosquito larvae die under oil treatment.

The fact that oils enter the tracheae of mosquito larvae was made the starting point of the investigations described and an attempt is made to supply answers to two questions :—Is the presence of oil in the trachea invariably fatal to larvae ? Does the presence of an oil film, covering the whole of the water surface, invariably lead to the penetration of oil into the tracheae of all the larvae under it ?

The inner surface of the trachea of a mosquito larva is wetted by oils but not by water. Its non-wettability by water is apparently explained by the presence of a layer of waxy material covering it.

The mosquito larvae used in the experiments were laboratory reared *Aëdes aegypti*, *Culex fatigans* and *Anopheles maculipennis*. Of these *C. fatigans* proved to be most useful : the tracheae of its larvae stand out very clearly when live larvae are examined under a 30-magnification binocular. In these conditions it is easy to see if, and to what extent, the tracheae have been oiled.

The presence of oil in the trachea of a larva is invariably fatal. In no case did a larva with an oil-filled trachea pupate although, in certain circumstances, death may be long delayed. Wide divergencies of survival time are, in some cases, due to differences in the amount of oil taken in. It is very doubtful whether a larva ever eats after it has been oiled. Penetration of oil into the larval tracheae is influenced by the nature of the oil spread and by the age of the film. Penetration was found to be most rapid with oils of middle boiling range (approximately 200°–300°C.). Oils of boiling range above 300°C. are less likely to penetrate, owing to their higher viscosity ; this was at any rate the case at the temperatures at which the experiments were carried out.

The penetrating power of the oil film deteriorates with the age of the film, though the thickness of the film influences the rate of deterioration. It appears, therefore, that endeavours to obtain a film of great durability are not justified.

The chemical composition of the oil determines its toxicity. Refined paraffin oils are non-toxic. Oils with a high proportion of aromatics are more rapid in their lethal action. In practice, however, toxicity is of secondary importance. The main desideratum is to obtain an oil that readily penetrates the trachea, that is to say, a medium boiling range oil, not so involatile as to be too viscous and not so volatile as to produce an immediate irritating effect causing collapse of the trachea.

The results obtained with pupae were somewhat contradictory. The pupae of *C. fatigans* are more difficult to kill with oil than are larvae ; they can survive in circumstances in which all larvae are oiled

with fatal result. Pupae of *A. maculipennis*, however, are much more susceptible to oil; this is probably explained by the different shape of the trumpets which, being oblique in the Anopheline pupa, present much larger openings for the oil to enter. *N. W.*

May (Raoul M.). L'hexachloréthane dans la lutte contre les moustiques. [**Hexachlorethane as a Mosquito Larvicide.**]—*Ann. Inst. Pasteur.* 1936. Sept. Vol. 57. No. 3. pp. 325–336. With 2 figs.

The disadvantages and limitations of mosquito larvicides hitherto employed were responsible for the investigations described in this paper, as a result of which the author believes that hexachlorethane, C_2Cl_6, is of very great value as a larvicide. The gas given off by hexachlorethane by sublimation kills adult mosquitoes and is not harmful to human beings. In a closed atmosphere 0·070 gm. in 10 litres of air kills adult mosquitoes in an hour and a half. Larvae and pupae in water exposed to air saturated with hexachlorethane all succumb. Such observations led the author to consider the possibilities of utilizing hexachlorethane as a larvicide though the idea of using a gas for this purpose is a new one.

The method finally adopted was to apply a mixture of two parts of hexachlorethane and one part of talc, both very finely powdered, to the surface of the water; a layer of gas is thus formed. It was found very difficult to grind pure hexachlorethane sufficiently fine: to overcome this difficulty it was dissolved in a slight excess of trichlorethylene. To the solution is added very finely powdered talc. After mixing, the trichlorethylene is evaporated by exposure to the air; the dry residue is ground and passed through a sieve. On a commercial scale it would be necessary to recover the trichlorethylene by distillation under reduced pressure at a low temperature.

A thin layer of the powder on the surface of the water suffices to kill all larvae and pupae. With a blower about five and a half kilograms were required to treat 100 square metres of surface.

The advantages claimed for the method are that the water treated is not rendered unfit for domestic use or for the watering of vegetables; that fish, crustaceans and water plants are unharmed; that the powder is not toxic either for man or animals; that the powder penetrates well amongst algae and other water plants; that it is not very costly, and that the larvae and pupae of all kinds of mosquitoes are killed. In short it is said to possess the advantages of both the oil and chemical larvicides hitherto in general use. *N. W.*

Danilova (M.) & Lappine (G.). Sur le transport des Gambusia. [**Transport of Gambusia.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1936. Vol. 5. No. 4. [In Russian pp. 579–582. French summary p. 583.]

The authors found that, if the journey does not last longer than 8 days and the vessel is open to free exchange of gases with the surrounding atmosphere and the temperature of the water is maintained at 13°–16°C., as many as 20 fish per litre can be safely carried. If the container has to be closed, as for example in a journey by rail, the same number can be carried provided the vessel is only half filled. Gambusia can live without feeding for a month, and if stored in an aquarium with

submerged vegetation much longer. The presence of rust is a negligible factor. With water containing vegetation a salinity of 1·5 per cent. does no harm, but where there is no vegetation, the fish may die when the salinity is only 1 per cent. *H. H. S.*

Koulaguine (S.) & Marzinovski (V.). Essai d'acclimatation des Gambusia dans les étangs réfrigérants d'une centrale electrique. [**Habituation of Gambusia to Refrigerating Pools.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1936. Vol. 5. No. 1. [In Russian pp. 52–61. [28 refs.] French summary (5 lines) p. 61.]

The authors have succeeded in acclimatizing Gambusia to the refrigerating pools of an electric central station in Moscow. The fish had been imported from the Caucasus. It was found that under the new conditions they thrived well and multiplied to a degree sufficient to permit of all the malaria stations where antilarval measures were undertaken to be supplied. *H. H. S.*

Boyd (Mark F.), Stratman-Thomas (W. K.) & Kitchen (S. F.). **Modifications in a Technique for the Employment of Naturally Induced Malaria in the Therapy of Paresis.**—*Amer. Jl. Trop. Med.* 1936. May. Vol. 16. No. 3. pp. 323–329.

All mosquitoes are bred in insectariums, no wild mosquitoes are used. A supply of 200 *A. quadrimaculatus* is always kept in cold storage and the stock is renewed every two weeks if not utilized. Their food consists of 10 per cent. glucose solution. The McCoy strain of benign tertian, which has been maintained for more than 4 years, is used for the treatment of white patients. *P. malariae* is not recommended. *P. falciparum* is employed in the treatment of negroes. Many different strains are used. Infected mosquitoes incubating the sporogonous cycle are kept at 20°C., with a relative humidity of 85 per cent.

Four infected mosquitoes are used in conveying *P. vivax* and 6 or 8 in the case of *P. falciparum*. Mosquitoes are not reliable for more than 30 days after infection with *P. vivax* and not more than 20 days after infection with *P. falciparum*. The course of the infection in man is controlled by counting the parasites. Parasite counts of over 100,000 in *P. falciparum* infections indicate the necessity for treatment.

W. F.

Rubinstein (B. N.). Die Behandlung der Impfmalaria bei Paralytikern mit dem neuen synthetischen Präparat Acrichin. [**Treatment of Inoculated Malaria with the New Drug Acrichin.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1936. Apr. Vol. 40. No. 4. pp. 167–169.

Acrichin (Dichlorhydrat-2-metoxy-6 chlor-9-diätylamino-butylamino-acrichin) is an analogue of atebrin. It was tested in cases of general paralysis inoculated with *Plasmodium vivax*. It has been found valuable in terminating the infection. No instance of relapse has been noted. The therapeutic effect of the malaria in general paralysis is not interfered with by acrichin, and there is no unfavourable action on the psychical condition of the patient. Acrichin is either given by mouth in doses of 0·1 gm. thrice daily for seven days, or by intravenous injection daily for one week, the dose being 5 to 8 cc. of a 3 per cent. glucose solution of acrichin, the same dose twice daily if given intramuscularly. Twenty-one cases were studied. *E. D. W. Greig.*

Bompiani (Gaetano). Le alterazioni del rene nella malaria sperimentale da "Plasmodium knowlesi" nel "Macacus rhesus."—*Sperimentale.* 1936. Aug. Vol. 90. No. 4. pp. 359–397. With 9 figs. [85 refs.] English summary.

Wang (C. W.). Two Cases of Malignant Malaria in Narcotic Addicts in Peiping: its Possible Transmission in the Intravenous Administration of Heroin.—*Chinese Med. Jl.* 1936. Mar. Vol. 50. No. 3. pp. 270–272.

Timpano (P.). Il metodo di M. Ascoli nella cura della splenomegalia da malaria e da kala-azar.—*Policlinico.* Sez. Prat. 1936. Nov. 9. Vol. 43. No. 45. pp. 2007–2009.

TROPICAL DERMATOLOGY.

A REVIEW OF RECENT ARTICLES, III.*

Blastomycosis.—During the past twelve months publications have been mostly concerned with the fungi causing chromoblastomycosis. Thus EMMONS and CARRIÓN[1] have worked with *Hormodendron pedrosoi*, the fungus most commonly found in cases of this disease in South America and Porto Rico. Their investigations have been most carefully executed. Many strains of the organism were obtained from different sources and were all compared with similar or related fungi. All the characteristic features of this agent are considered and it is shown that it is closely allied to the saprophytic species of the genus in its similar but slow growth habit, its pigmentation and its production of branching chains of spores. The subterminal elements of these chains are true spores and this chain formation distinguishes the fungus from the *Acrotheca* and *Trichosporia*. Successful animal inoculations have been carried out with some saprophytic species of *Hormodendron*, so adding to the evidence demonstrating the close relationships which exist between the pathogenic and saprophytic species. CARRIÓN[2] draws attention to a new clinical type caused by *H. compactum*, for the fungus isolated from the lesions appears to belong to a new species. The organism is described in great detail and among its features the following differences are mentioned. Growth is always slow and cultures on maltose agar never attain the size of *H. pedrosoi*. The culture is irregular, uneven and tufted, never smooth and regular. The edge is indented and scalloped, whilst the substrate is a hard and brittle mat instead of being elastic. On dextrose agar the hyphae of *H. compactum* are coarser, the cell-walls are thicker and more irregular, whilst the cells themselves show more pigmentation and larger droplets. This organism was obtained from lesions present on the left arm of a white labourer in Porto Rico. This man, now aged fifty, first noticed a small growth on the front of the left wrist twenty-eight years ago. The original nodule gradually spread so as to involve most of the limb up to the middle of the arm. The spread always occurred by peripheral extension and not by the satellite deposits which are seen in other cases of this disease. The lesions themselves were mostly psoriasiform, dull red or violaceous in colour. In places there was slight papillomatosis and ulceration but no nodules or large vegetative tumours were found. Lastly, in some areas the appearance was very suggestive of lupus erythematosus. The first case of chromoblastomycosis to be detected in Uruguay was described in the *Arch. Urug. med. cir. esp.*, 1934, Vol. 5, p. 201. The fungus then isolated has now been studied very fully by MACKINNON[3] and the organism appears to be identical

* For the second of this series see Vol. 33, p. 138.

[1] EMMONS (C. W.) & CARRIÓN (A. L.). *Hormodendrum pedrosoi.* An Etiological Agent in Chromoblastomycosis.—*Puerto Rico Jl. Public Health & Trop. Med.* 1936. June. Vol. 11. No. 4. pp. 639–650. With 29 figs. on 6 plates. [10 refs.] [Spanish version pp. 651–662.]

[2] CARRIÓN (A. L.). Chromoblastomycosis. A New Clinical Type caused by *Hormodendrum compactum.*—*Puerto Rico Jl. Public Health & Trop. Med.* 1936. June. Vol. 11. No. 4. pp. 663–682. With 8 plates. [15 refs.] [Spanish version pp. 683–702.]

[3] MACKINNON (J. E.). Description d'une souche de *Phialophora verrucosa* Thaxter (Medlar, 1915) isolée du premier cas de dermatite verruqueuse observé en Uruguay.—*Ann. Parasit. Humaine et Comparée.* 1936. Jan. 1. Vol. 14. No. 1. pp. 78–84. With 1 fig.

with *Phialophora verrucosa* Thaxter. It is claimed that Medlar's description of this fungus in 1915 was incomplete and that this paper does actually round off the study of the organism. A typical case of chromoblastomycosis is portrayed by MARTIN, BAKER and CONANT[4] in a well-illustrated article, the patient being a North Carolina negro having disease of the left hand and arm of four years' duration. They claim that very definite improvement occurred after iontophoresis with copper sulphate. But the most interesting part of the paper concerns the pathological investigations. They found specific complement-fixing bodies to the fungus (*H. pedrosoi*) in the serum. Also when the blood was tested against fourteen other strains of fungi of the Hormodendron type all but one of these fixed the complement to some degree.

Mycetoma.—One example of this disease is reported from Montevideo by TALICE,[5] but clinical details are restricted to the statement that a small nodule was excised from the finger of a male native. From the mycological point of view the outstanding feature was the presence of reddish-orange grains, the largest of which measured 200 μ in diameter. This constitutes the second report in the literature, the first case having been seen in 1918 in the Anglo-Egyptian Sudan by BALFOUR and ARCHIBALD. The author proposes to create a new genus for this fungus, *Rubromadurella* and to call this species *R. langeroni*.

Actinomycosis.—TALICE[6] is also responsible for the first description of mycotic concretions in the lachrymal ducts to be reported from Uruguay. In these ducts, particularly in the lower lids, there were found multiple tiny, soft, friable, greyish or yellowish grains. Calcareous infiltration was found in the older masses. Clinically there was some swelling at the edge of the affected eyelid, with a little local conjunctivitis at the puncta but there was no actual invasion of the tissues. The disease is rare but is generally distributed throughout the country and is seen in female farm workers. It seems probable that the only causative fungus is that most common of the saprophytic actinomyces, *A. israeli*. The same author in collaboration with SICARDI and REGULES[7] also describes a case in which an actinomyces (species undecided) actually invaded the tissues of the eye. The disease followed local injury with a piece of dry wood, some splinters of which remained in the wound with consequent intense local inflammation and suppuration. At first antiseptic dressings only were used but gradually small nodules appeared round the cornea, all below the level of the original wound. These globules were of 1 to 2 mm. in diameter, bright red and each bore a central yellow point. Puncture

[4] MARTIN (Donald S.), BAKER (Roger D.) & CONANT (Norman F.). A Case of Verrucous Dermatitis caused by *Hormodendrum pedrosoi* (Chromoblastomycosis) in North Carolina.—*Amer. Jl. Trop. Med.* 1936. Sept. Vol. 16. No. 5. pp. 593–619. With 5 plates. [24 refs.]

[5] TALICE (R. V.). Sur un cas de maduromycétome à grains rouges observé à Montevideo.—*Ann. Parasit. Humaine et Comparée.* 1935. Nov. 1. Vol. 13. No. 6. pp. 585–590. With 1 fig.

[6] TALICE (R. V.). A propos d'un cas de concrétions mycosiques primitives des canaux lacrymaux.—*Ann. Parasit. Humaine et Comparée.* 1936. Mar. 1. Vol. 14. No. 2. pp. 164–170. With 3 figs.

[7] SICARDI (J. A.) ; REGULES (U.) ; TALICE (R. V.). Un cas intéressant d'actinomycose conjonctivosclérale d'origine traumatique. I. Etude clinique [SICARDI & REGULES]. II. Etude mycologique [TALICE].—*Ann. Parasit. Humaine et Comparée.* 1936. Mar. 1. Vol. 14. No. 2. pp. 171–176. With 1 fig.

yielded a muco-purulent liquid. Treatment with potassium iodide internally and sodium iodide locally was instituted. Healing then occurred but left a grey-blue discoloration at the site, which it is claimed is characteristic of old conjunctivo-scleral actinomycosis. From Japan there comes the report of a case of "dermatitis verrucosa" by KAMBAYASHI and ANDO,[8] this being the second case to be described in that country. The patient was a nineteen-year-old lad who lived in Tokio and who gave a nine years' history. The disease started on the right great toe on that part of the skin where the thong of the sandal produces some friction. The toe and adjacent part of the dorsum of the foot were swollen, brownish and bore livid dark red nodules. Crusts and sinuses were also present. A similar patch covered an area of two inches diameter below the external malleolus of the right leg, which as a whole was larger than the left leg. Histological and cultural details are included in the paper and there seems no doubt that the fungus was an actinomyces.

Cephalosporium.—The whole literature of infections with this organism is reviewed by KROEMER[9]. In Central Europe some cases start like an impetigo with, later, deep pustules; others show subcutaneous "gummatous" nodules which may also be found in the mucous membranes and which are very suggestive of actinomycosis of the jaw. The author worked with two strains of the fungus and concludes that the various types which have been described by Benedek, Grütz and Pollacci are all really identical one with another and with *C. acremonium*, Corda.

Sporotrichosis.—From Uruguay comes the report by TALICE[10] of two cases of this disease in which the *S. asteroides* of Splendore was isolated. Although both patients had gummatous lymphangitis of the forearm, only one of them is described in detail. This account deals with a native laundress, aged 28, whose single lesion had been present for seven years. From one sinus a little brownish clear fluid could be expressed. Local anaesthesia allowed complete excision of this "gumma." The rest of the paper is concerned with pathological investigations, and is concluded by the reasons why the author regards the organism (sporothrix) as a variety of *Rhinocladium beurmanni*.

Coccidiosis.—The article by JORDAN and WEIDMAN[11] deserves very close study. In North America most cases of coccidioidal granuloma are due to *C. immitis*, whilst in South America *Paracoccidioides brasiliensis* is the usual offender. Confusion has arisen because the differences between these two organisms have not been fully appreciated and the authors confirm Almeida's original conclusion that the two are radically different. Among the very full details considered the

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[8] KAMBAYASHI (T.) & ANDO (K.). Ein Fall von Dermatitis verrucosa in Japan.—*Arch. f. Dermat. u. Syph.* 1936. July 13. Vol. 174. No. 4. pp. 377–384. With 7 figs.

[9] KROEMER (Gerhard). Ueber die bisher bekannten menschlichen Cephalosporium-Infektionen, nebst Untersuchungen ueber zwei verschiedene Stämme von Cephalosporium acremonium Corda.—*Ztschr. f. Parasitenk.* 1936. Mar. 4. Vol. 8. No. 3. pp. 317–331. With 8 figs. [28 refs.]

[10] TALICE (R. V.). Deux cas de sporotrichose produits par le *Sporotrichum* astéroïde de Splendore.—*Ann. Parasit. Humaine et Comparée.* 1935. Nov. 1. Vol. 13. No. 6. pp. 576–583. With 1 fig.

[11] JORDON (James W.) & WEIDMAN (Fred D.). Coccidioidal Granuloma. Comparison of the North and South American Diseases with Special Reference to Paracoccidioides Brasiliensis.—*Arch. Dermat. & Syph.* 1936. Jan. Vol. 33. No. 1. pp. 31–47. With 6 figs. [13 refs.]

following features may be mentioned. The colonies of *C. immitis* are large and spreading, the mycelium develops rapidly in hanging-drop preparations and in them chlamydospores, arthrospores and clubbing of terminal hyphae can be observed ; the round forms occur only in tissue. Pathogenicity for animals is high and affects many species. The colonies of *P. brasiliensis* are small and compact, whilst in hanging-drop preparations the mycelium is confined to the region of the ex-plant and there are numerous chlamydospores. No round forms are seen in tissue and its pathogenicity for animals is low, being confined to rats. It is therefore concluded that paracoccidioidal granuloma is a third disease which must be added to blastomycosis and coccidioidal granuloma when the differential diagnosis arises. Clinically the cutaneous lesions of these two coccidioidal diseases are practically identical, but in the Brazilian form the portal of entry seems to be around the mouth. The Brazilian disease causes marked adenopathy but *never* shows involvement of bones. A more recent paper by Silva[12], however, describes four cases of infection with the *P. brasiliensis*, three of which showed rare features. One case of four years' duration did not have any invasion of the mucous membranes. The second patient also suffered from a lung cavity caused by the fungus, whilst the last did have slight but definite bone involvement. This writer also stresses the differences between the North and South American varieties both clinically and culturally.

Favus.—Langeron and Baeza[13] report the results of a study of the fungi obtained from 304 cases of favus seen in the Spanish zone of Morocco. Morphological and cultural details are full. The authors divide the organisms into three groups :—(*a*) typical *Achorion Schönleini*, which grows on the surface of the medium ; (*b*) growths which are more adherent and which show superficial invasion of the medium, such as the types *pittalugai*, *talicci*, *debueni* and *brumpti* ; (*c*) fungi which penetrate deeply into the medium, type *milochevitchi*. There is a final discussion of the whole group of *Favotrichophyta*, as suggested by Neveu-Lemaire in 1921. The natural course of the disease has been rarely studied, but Catanei[14] has kept 23 native children under observation in Algeria for periods of two to seven years. The patients, of whom nineteen were boys, varied from two to thirteen years of age. They all had lesions of the scalp whilst seven of them also showed affection of the glabrous skin. No treatment whatever was given and the children were frequently examined. It was found that the disease heals spontaneously, often without leaving any definite scars. Even in the worst and most chronic cases patches of local recovery had appeared before the conclusion of the period of observation. What may prove to be a new species is reported from India, where Dey and Maplestone[15] obtained material from a boy living in

[12] Silva (Flaviano). Commentarios em torno de alguns casos de blastomycose por " Paracoccidioides brasiliensis " observados na Bahia.—*Brasil-Medico.* 1936. Aug. 15. Vol. 50. No. 33. pp. 706–715. With 15 figs. French summary.

[13] Langeron (M.) & Baeza (M.). Sur les dermatophytes qui causent la teigne faveuse humaine.—*Ann. Parasit. Humaine et Comparée.* 1936. July 1. Vol. 14. No. 4. pp. 385–402. With 36 figs. on 6 plates. [14 refs.]

[14] Catanei (A.). Évolution naturelle du favus en milieu indigène algérien.—*Arch. Inst. Pasteur d'Algérie.* 1935. Dec. Vol. 13. No. 4. pp. 495–509. With 5 plates.

[15] Dey (N. C.) & Maplestone (P. A.). Favus in India.—*Indian Jl. Med. Res.* 1936. Jan. Vol. 23. No. 3. pp. 687–699. With 17 figs. (9 coloured) on 5 plates & 1 text fig.

Rajputana. The characters of this fungus are described very fully. It has end-organs similar to those of *A. Schönleini* but it has additional funnel-shaped terminal chlamydospores. The name *A. actoni* n. sp. is suggested.

Tinea tonsurans.—In Calcutta DEY and MAPLESTONE[16] have seen 53 cases of ringworm of the scalp during the last three years. Of these, 2 were due to favus, 20 to *T. violaceum* and the rest were caused by *M. audouini*. There were no unusual clinical features. It is noteworthy, however, that this is the first record of the occurrence of *T. violaceum* in India. For this reason the cultures of the fungus are described very fully and it is observed that "the violet colour always fades and finally disappears on repeated subculture." It is suggested that on botanical grounds this organism would be more correctly classed as an Achorion, the name which was actually first given to it in 1902 by Bodin. During this investigation no other species of Trichophyton was found. CATANEI[17] continues his studies in North Africa and has now reported his findings in Aures, a mountainous part of Algeria. Here 528 children under sixteen years of age were seen. The incidence of infection varied greatly in different settlements, the disease being completely unknown in some. Favus (*A. Schönleini*) was more common than trichophytic infections but where the latter do occur, *T. violaceum* and *T. glabrum* are responsible. Clinically all the lesions seen in this district were localized and attenuated. The same author[18, 19] discusses the difficult subject of acquired resistance in mycotic diseases. Trichophytic, sporothritic, blastomycotic and actinomycotic infections are all considered. He claims that all give rise to allergy and that this is the cause of the aggravation sometimes seen as a result of superinfection or inoculation of antigens. In the superficial types of fungus infection, allergy only appears after invasion of the hair has occurred. Deep infections with pus-formation establish a resistance against superinfection, *i.e.*, an acquired resistance in which clinical cure coincides with disappearance of the organism. There is no latent stage in which fungi are present without clinical signs. A few mycotic lesions seem to be succeeded by true immunity. That allergy really can exist during the period of infection is shown not only by the reactions to such antigens as trichophytin but also by the spontaneous appearance of the "ide" eruptions. PENNINGTON[20] points out that fungus sensitivity is a frequent cause of the allergic dermatoses, but it is very often combined with other sensitizations, *e.g.*, to foods and inhalants. These allergic lesions mostly occur on the hands and feet, a distribution which is by no means a reliable criterion as to

[16] DEY (N. C.) & MAPLESTONE (P. A.). Ringworm of the Scalp in India.—*Indian Med. Gaz.* 1935. Oct. Vol. 70. No. 10. pp. 541–544. With 4 figs. & 1 coloured plate. [12 refs.]

[17] CATANEI (A.). Les teignes dans des agglomérations indigènes de l'Aurès.—*Arch. Inst. Pasteur d'Algérie.* 1936. Mar. Vol. 14. No. 1. pp. 9–14.

[18] CATANEI (A.). Les caractères de la résistance acquise dans les mycoses.—*Bull. Soc. Path. Exot.* 1936. May 13. Vol. 29. No. 5. pp. 451–457. [20 refs.]

[19] CATANEI (A.). Les caractères de la résistance acquise dans les mycoses (immunité ou prémunition ?).—*Arch. Inst. Pasteur d'Algérie.* 1936. June. Vol. 14. No. 2. pp. 85–103. [27 refs.]

[20] PENNINGTON (Edna S.). An Evaluation of the Relative Rôle of Fungi (Trichophytin) and Other Allergens in Patients with Allergic Dermatoses.—*Southern Med. Jl.* 1936. Apr. Vol. 29. No. 4. pp. 407–410. [14 refs.]

the possible cause. Tests involving the use of trichophytin or oidomycin are only trustworthy when focal reaction appears. When this does occur good results are obtained by specific treatment involving desensitization with fungus extracts. This paper is based on the study of 155 patients, 93 of whom were sensitive to fungi. In only 46 of these 93, however, was fungus sensitization the sole cause of the eruptions.

Epidermophytosis.—SOUTER[21] has studied 114 cases of mycotic infections of the feet. In his hands Mycozol has proved the most efficient treatment but nevertheless he is not prepared to swear that even one of these cases is absolutely cured, the longest period of observation being only seven months. He stresses the great importance of frequent changing of the socks, powdering of the feet after washing, the use of special towels, etc. The following routine treatment is suggested: a preliminary seven days antiseptic course during which the feet are bathed twice a day in Eusol. After each bath the feet are dried and then dressed with Whitfield's lotion or Castellani's paint. At the end of this period liquid Mycozol is applied twice a day for "three weeks or more as necessary." In Louisiana HOWLES[22] has investigated 2,086 cases of infectious intertrigo occurring over a period of twenty months in a prison which houses 1,800 convicts. The disease was found in 86·5 per cent. of new admissions and in 96·1 per cent. of inmates. Various cocci, yeasts and fungi were found, but in only 10 per cent. of the cases were pathogenic fungi discovered. Of these, *E. interdigitale* was the most common.

Monilia.—The comparative virulences of 27 strains of Monilia have been considered by MACKINNON and RODRIGUEZ-GARCIA.[23] Emulsions of the fungi were made in normal saline and were then injected into rabbits and mice, either intravenously or by the intraperitoneal route. They concluded that there is some relationship between the morphological types and the degree of virulence. Thus *Mycotorula* and *Candida* proved most pathogenic. *Mycotoruloides* and *Geotrichoides* take second place, whilst *Mycocandida* comes next and *Blastodendrion* proved the least virulent. It is believed that these findings are sufficiently stable to be of assistance in the identification of the various members of this group.

Animal Parasites.—Human infection with those members of the acari known as Demodex is sufficiently rare to excite interest. BATUNIN and IOLKIN[24] have studied the history of these infections (Demodicitis hominis) in both animals and man. Occasionally the spider may be found on an apparently normal skin; more often it may be found in eruptions which simulate eczema, impetigo or seborrhoeic dermatitis. Thorough treatment with a sulphur and salicylic acid ointment results in cure in those dermatoses when such an ointment might reasonably

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[21] SOUTER (J. C.). A Note on Fungoid Infections of the Feet with a Description of a Case.—*Jl. Roy. Nav. Med. Serv.* 1936. Jan. Vol. 22. No. 1. pp. 41–45. With 3 figs.

[22] HOWLES (James K.). Infectious Intertrigo.—*Amer. Jl. Trop. Med.* 1936. Jan. Vol. 16. No. 1. pp. 77–90. With 3 charts. [12 refs.]

[23] MACKINNON (J. E.) & RODRIGUEZ-GARCIA (J. A.). Mesure et comparaison du degré de virulence des champignons levuriformes.—*Ann. Parasit. Humaine et Comparée.* 1936. July 1. Vol. 14. No. 4. pp. 403–407.

[24] BATUNIN (M.) & IOLKIN. Acariasis seu Demodicitis hominis.—*Dermat. Woch.* 1935. Nov. 2. Vol. 101. No. 44. pp. 1355–1361. With 5 figs.

be expected to make matters worse, thereby suggesting that the rash really is consequent on the presence of the parasite. Diagnosis of course depends on microscopy. A most important paper comes from the pens of SULZBERGER and KAMINSTEIN[25], in which is discussed the problem of human dermatoses caused by the mites of animals. After dealing briefly with the many types of animal acarine infections the authors pass to the eruptions due to non-burrowing mites such as the Trombidiidae and Gamasidae. The whole literature is reviewed and then an account is given of two groups of cases seen in New York City within one year. All of these were attributable to the ordinary red chicken-mite, *Dermanyssus gallinae*. In the first group three members of a family of four were affected, the husband being very heavily attacked. Each patient showed very numerous widespread scratch marks together with occasional pinhead-sized reddish papules and isolated, evanescent urticarial wheals. The thighs, legs, lower abdomen and waistline were particularly affected, the face remaining clear. It was noticed that itching increased very greatly after the death and subsequent handling of a pet canary which had scratched and bitten itself severely. The second group of cases was exactly similar and in them it had even been noticed that the trouble started soon after the purchase of a canary and that a sheet put over the cage at night was covered with " red spots " in the morning. Mites were found in both the cages concerned. The diagnosis may be suggested by more marked urticaria than is usually seen in scabies and by the great variations in susceptibility among individuals of the family. As it takes four to five months to rid a poultry house of these mites when once it has been infected it is obvious that simple removal of bird and cage may not result in rapid alleviation of the symptoms.

Keratoma palmare et plantare.—NADEL[26] reviews the literature of this disease very thoroughly and points out that somewhat similar conditions have been described under various names. He then describes the changes seen in a nine-year-old boy of Lemberg in whom the abnormalities were first noticed two months after birth. The palms showed well-defined patches of marked hyperkeratosis, real horny masses. The soles were covered with a thick brownish layer of hyperkeratosis with deep fissures, the horny plateaux ending abruptly at the edges of the soles. They were surrounded, however, by a bluish-red area of 2 cm. diameter. The nails of the hand were thickened, but those of the toes were thinner than normal. In spite of the horny thickening there was marked hyperidrosis of the feet. Patches of thickened and fissured skin were also present at the right angle of the mouth and over the coccyx. Inside the right cheek were small sheets of leucoplakia. Musculature was generally atrophic, particularly in the legs and was apparently due to disuse. Teeth were normal but hair was somewhat scanty. Clubbing of the fingers and chronic bronchitis were also present. Radiography revealed thinning of the skull bones and calcification of the foot joints. Intelligence was only that of a child of four. This case therefore combines all the features of those previously described by Unna, Thost, Jadassohn and Lewandowsky.

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[25] SULZBERGER (Marion B.) & KAMINSTEIN (I.). Avian Itch Mites as a Cause of Human Dermatoses. Canary Birds' Mites responsible for Two Groups of Cases in New York.—*Arch. Dermat. & Syph.* 1936. Jan. Vol. 33. No. 1. pp. 60–71. With 1 fig. [24 refs.]

[26] NADEL (A.). Keratoma palmare et plantare atypicum.—*Arch. f. Dermat. u. Syph.* 1936. July 13. Vol. 174. No. 4. pp. 404–412. With 6 figs.

Pityriasis rubra benigna.—A definite syndrome has been observed by MAPLESTONE and GHOSH[27] in 100 cases. It is characterized by the patchy distribution of erythema, exfoliation and itching. Because fatalities are rare the above name is proposed by the authors. At the same time they point out that Crocker recognized this type but that references to it are absent from modern literature. The erythema is intense and acute whilst the exfoliation of fine scales is continuous. Patients are otherwise healthy but soon begin to suffer from inadequate rest and malnutrition. When the chronic stage is reached some lichenification and pigmentation appear. It is usual to find that the flexures of the knees, elbows and neck are affected, which areas may relapse year after year during the summer months. No aetiology has been discovered but allergy seemed to play a part in 23 cases. The patients were mostly males between the ages of 20 and 40. Local remedies were confined to symptomatic treatment whilst the internal administration of arsenic and antimony and non-specific protein shock seemed to help.

Lupus erythematosus.—This disease is less common among negroes than it is among whites. CUMMER[28] describes a case in a negro and suggests that the relative rarity of the condition may be explained by the fact that deeper pigmentation protects against the sun's rays. He also mentions that the incidence of tuberculosis is greater among negroes, and so concludes that there is either no relationship between the two diseases or that the pigment protects the skin in spite of the greater susceptibility to tuberculosis. In considering this question of sunlight reference must be made to SPIES[29] article in the *Archives of Internal Medicine.* In it he discusses pellagrous dermatitis and demonstrates that this is really a deficiency disease, by no means limited to the tropics.

Acanthosis nigricans.—STRANDELL[30] has treated two cases of this disease in Sweden by means of intragluteal injections of a highly active liver preparation, Heptomin. On an average 4 cc. are administered each week either as a single or in two injections. In both cases there occurred definite decrease in the pigmentation and a lessening of the papillomatosis as well as a marked improvement of the concurrent anaemia. *Sydney Thomson.*

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[27] MAPLESTONE (P. A.) & GHOSH (L. M.). A Study of One Hundred Cases of Dermatitis.—*Indian Med. Gaz.* 1936. Aug. Vol. 71. No. 8. pp. 451–458. With 6 figs.

[28] CUMMER (Clyde L.). Etiology of Lupus Erythematosus: Occurrence in the Negro.—*Arch. Dermat. & Syph.* 1936. Mar. Vol. 33. No. 3. pp. 434–443. With 4 figs. [18 refs.]

[29] SPIES (Tom D.). Relationship of Pellagrous Dermatitis to Sunlight.—*Arch. Intern. Med.* 1935. Nov. Vol. 56. No. 5. pp. 920–926. With 3 figs.

[30] STRANDELL (Birger). Acanthosis nigricans—Besserung nach Leberinjektionen.—*Acta Med. Scandinavica.* 1936. Vol. 87. No. 5–6. pp. 551–556. With 4 figs.

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